Ecotourism in Nicaragua

Impacts on the Vegetation Diversity In Natural Reserve Datanlí – El Diablo

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PREFACE

This master's thesis was performed within the Program of Natural Resources at the Swedish University of Agricultural Sciences in Uppsala and comprises 20 weeks of studying at D-level, both in Sweden and in Nicaragua. The literature review was conducted at the Department of Urban and Rural Development in Uppsala, Sweden, in August to October, 2006. The field survey was made in collaboration with ing. Matilde Somarriba Chang and Universidad Nacional Agraria in Nicaragua. Field studies were performed in October to December, 2006.

I would like to thank my supervisor in Sweden, Hans-Georg Wallentinus for helping me before and after the field trip to Nicaragua. I am also grateful for all the help from Matilde and the university in Nicaragua as well as the support from the Nicaraguan students, especially Jeffte, Carlos and Mauricio.

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ABSTRACT

Between the years of 1990 and 2000, the number of tourists increased with more than hundred percent globally, and more than three hundred percent in Nicaragua. Further, this industry contributes to eleven percent of the gross domestic product of the world and is, from an economic point of view, regarded as one of the biggest industries worldwide. However, tourism often conveys negative secondary effects on the local environment and contributes to unfair use of local cultures for commercial purposes.

To avoid this, the concept of ecotourism has evolved. Ecotourism is a type of tourism that strives to respect local communities and sustainable use of the resources. A common definition of the movement is stated by the International ecotourism society; *"Responsible travel to natural areas that conserves the environment and improves the well-being of local people".*

Ecotourism has recently been established in Datanlí – El Diablo, a natural reserve located between the cities of Matagalpa and Jinotega, in the north of Nicaragua. Due to this, investigations and communications with local communities are now crucial.

The goal of this thesis was to investigate possible changes in the vegetation of the cloud forest, which may be due to impacts of ecotourism. Inventories of the vegetation close to two walking trails were carried out during October to December, 2006. The surveys resulted in calculation of species richness and distribution.

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CHAPTER 1

Introduction

How can the biodiversity of tropical forests be preserved without compromising the livelihood of local societies? Are there economically sustainable alternatives to the deforestation that today occurs in the tropics? The relevance of these questions is the main reason to my interest in ecotourism. I nourish a will to find ways to improve the economical situation for humans in southern countries, without ruining the species rich, beautiful and important tropical forests.

Tourism has grown with more than hundred percent globally, and more than three hundred percent in Nicaragua, between the years of 1990 and 2000. Further, it contributes to eleven percent of the gross domestic product of the world and is regarded as one of the biggest industries worldwide, from an economical point of view (CI, 2003). These facts generate an interest in tourism among governments and organisations worldwide. By combining tourism with preservation of the environment, an increase in the interest and development of knowledge, regarding the environment, can be reached.
Ecotourism may be an important alternative to gain cash incomes and improve the livelihood of inhabitants at a site, without causing degradation of the forests and loss of biodiversity. To fulfil that, this type of tourism has to be further investigated and refined to diminish the negative effects on the environment and local communities that occur today.

One of the problems regarding ecotourism is that it is developed without satisfying knowledge of the impacts on local environments. It is a relatively new type of tourism and yet there are few unequivocal papers written in this field. As far as I concern, ecotourism is today more sustainable than conventional tourism partly because of its' smaller scale, which gives the possibility to control the behaviour of tourists and duration of the journey. When tourist groups are small and there is an abundance of guides in each group, it is much easier to diminish the impacts of the local environments. As the ecotourism industry grows, finding ways to remain low impacts on the environment without compromising the economic interest of the local people, will become more and more important. Today, one can see a trend in higher prices in ecotourism activities, which exclude the tourists that are willing to perform a sustainable form of tourism but can not afford the charge. To succeed in creating sustainable tourism, available for more than just an exclusive group, more research and investigations are essential.

Through this paper, I wish to increase the knowledge about ecotourism's impact on the vegetation in a natural reserve in Nicaragua. By that, contribution to the development of a more sustainable ecotourism, that to a larger extent respects the carrying capacity of the vegetation may be achieved.

During the fieldwork, I measured the effects of ecotourism by investigating the vegetation in a natural reserve, where ecotourism is now being developed. The surveys resulted in calculations of species richness by a walking trail, to find out whether there are differences in the vegetation diversity, possibly caused by ecotourism. Time was the most limiting factor during the fieldwork and had to be carefully considered when choosing survey methods. Due to the rich vegetation in the rainforest and the remote area of investigation, I choose a

commonly used, relatively simple method that showed the relation between less affected and affected forest. The statistic methods were selected based on the type of data I had and the expected outcome of the survey.

The questions I will answer through the literature review are;
How is sustainability defined?
What are the definitions of ecotourism and how has that type of tourism been developed?
What distinguishes ecotourism from conventional tourism?
What are the benefits and constrains regarding ecotourism?
What procedure has to be considered when planning for ecotourism in Nicaragua?

The subject of the field survey is to investigate changes in the vegetation of the cloud forest in Datanlí – El Diablo, a natural reserve in Nicaragua, which may be due to impacts of ecotourism. The methods used for the fieldwork were carefully chosen and resulted in gradients of biodiversity richness and calculation of biodiversity indices (to see the proportions of species within the area).

The hypothesis is, that ecotourism in Nicaragua affects the vegetation and reduces the number of species, as well as changes the composition of species in the cloud forest.

I do not take a stand in whether changes in biodiversity are only negative or additionally positive for the local environment and the cultures in the area. When deciding changes to be negative or positive, consideration has to be taken to who benefits and who experience disadvantage of the tourism collate rich biodiversity. Discussion of what species that are more or less important and if, and for whom, a decreasing biodiversity is negative, have to be achieved. However, these questions belong to the fields of anthropology and philosophy as well as biology and will therefore not be discussed in this paper. I will state out the changes in biodiversity to provide information for further research but leave the decisions whether the changes are good or bad to other studies.

The target groups are students and scientists who wish to further investigate how ecotourism can be developed to achieve reduction of the negative impacts on the vegetation diversity that occur today.

Definitions:

Tourist – *"A person travelling for pleasure for a period of at least one night, but not more than one year for international tourists and six months for persons travelling in their own countries, with the main purpose of the visit being other than to engage activities for remuneration in the place(s) visited"* (Fennell, 2003)

Ecotourism - *"Responsible travel to natural areas that conserves the environment and improves the well-being of local people"* (TIES, 2006)

Sustainability – "*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs"* (Brundtland *et al.,* 1987)

CHAPTER 2

Literature review

2.1 Methods used in the literature review

The methods used was mainly collecting information from the literature and searching for published articles on internet using the keywords; *ecotourism, Nicaragua, sustainability* and *rainforest*. In creation of the survey, communication with scientists and PhD students in this field and studying literature from previous courses at the SLU, were of great importance. During the stay in Nicaragua, information concerning the study area and species of plants, was collected at the UNA.

2.2 Sustainability

The goal of sustainability is *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs"* (Brundtland *et al.,* 1987). Thus, sustainability is not a definition of "no effect at all" but rather creation of impacts that are small enough not to jeopardize the survival of species to future generations. The limits of when sustainability is achieved are hard to point out. Nevertheless, by using tools such as determination of carrying capacity and limits of acceptable change, one tries to manage tourism and still reach sustainability.
Threats to sustainable development of tourism are mostly constituted by three sections:

1. Impacts on the physical environment, e.g. trampling and disturbance of wildlife.
2. Competition with alternative use of the area e.g. agriculture.
3. Recreational disturbances caused by other tourists, e.g. crowdedness (Emmelin, 1995)

To avoid these impacts and succeed development of sustainable tourism, certain principles; such as sustainable use of resources, reduction of over consumption and waste, integration of tourism in management planning of an area, involvement and support of local economies, cooperation between all stakeholders, careful marketing and training of staff, has to be fulfilled (Fennell, 2003).

2.2.1 Carrying capacity

One aspect to consider, when struggling towards sustainability, is to respect the carrying capacity of an area. Carrying capacity is the maximal level of use, which can be persuaded without major impacts on the environment i.e. how large population that can sustainable use an area. The carrying capacity is divided onto three levels; physical carrying capacity, real carrying capacity and effective carrying capacity. Physical carrying capacity is calculated from the physical impact on the environment caused by each visitor e.g. the width of a walking trail. The real carrying capacity adds estimations of soil erodibility, distance between tourist groups etc. Effective carrying capacity consists of real carrying capacity as well as economy, such as facilities and staff required (Somarriba Chang *et al.*, 2006). Indications of exceeding the carrying capacity are reduction of the recreational capacity of the site (the facility carrying capacity), decrease in the biodiversity (the ecological carrying capacity) or negatively affection of the culture or economy of a society (the socio-cultural carrying capacity). The level of impact is often difficult to measure and the limit where carrying capacity is reached is therefore hard to distinguish (Wearing & Neil, 1999).

However, the two characteristics that strongest influence the carrying capacity are doubtless the tourists' characteristics (e.g. activity, duration of stay, density and behaviour) and the characteristics of the tourist site and local human population (e.g. weather, topography, vegetation, local economy, culture, politics, development) (Mathieson & Wall, 1982).

2.2.2 Limits of acceptable change (LAC)

Limits of acceptable change (LAC) is a framework where biological, physical and social impacts of a site are assessed in conduction of management methods. In assessment of LAC, the maximum changes allowed in a specific site are to be considered not only by managers, but also scientists and local communities. The pillars of the LAC system is determination of what is to be protected, understanding of changes as a normally existing state in the nature and awareness of the fact that recreation in natural environments always cause changes. The question LAC systems attempt to answer is how much changes can be accepted and constructiveness of the site management (Wearing & Neil, 1999; Somarriba Chang, 2004).

In the book "Ecotourism, Impacts, potentials and possibilities" (1999), Wearing & Neil point out nine steps in the LAC planning system.

- Identifying concerns and issues.
- Defining and describing opportunity classes.
- Selecting indicators[1] of resource and social conditions.
- Carrying out an inventory of resource and social conditions.
- Specifying standards for the resource and social conditions.
- Identifying alternative opportunity class allocations.
- Identifying management actions for each alternative.
- Evaluating and selecting an alternative.
- Implementing actions and monitoring condition.

2.2.3 The convention on biological diversity

The convention on biological diversity is an agreement of 170 countries world wide, to preserve diversity of ecological environments. The agreement was signed in 1992 and established in December 1993. Reaching sustainability to preserve variation of species, genetic material and collaboration between species are the pillars, in which the convention is based. The main purpose is to encourage protection of the environment on basis of conditions in each country, rather than being a strict law (Grandin & Goedkoop, 2005).

[1] Features that represent the conditions in chosen opportunity class (Somarriba Chang, 2004).

2.3 Ecotourism

The 2.3.1 Ecotourism definitions

One of the problems regarding ecotourism is that it has no clear definition. Commonly, organisations and companies define ecotourism to fit their own purposes and goals. By that, degradation of the word ecotourism is now generated and definitions are nearly meaningless (Duhá Buchsbaum, 2004). However, one of the most commonly used definitions in the academic world is developed by the International ecotourism society; *"Responsible travel to natural areas that conserves the environment and improves the well-being of local people"* (TIES no 1, 2006). A more realistic definition that fits the actual purpose of ecotourism today is Martha Heart's; "*ecotourism is travel to fragile, pristine, and usually protected areas that strives to be low impact and (usually) small scale. It helps educate the traveller; provides funds for conservation; directly benefits the economic development and political empowerment of local communities; and fosters respect for different cultures and for human rights"* (Honey, 1999). Another definition, which is relatively close to the previous is *"low impact nature tourism which contributes to the maintenance of species and habitats either directly through a contribution to conservation and/or indirectly by providing revenue to the local community sufficient for local people to value, and therefore protect, their wildlife heritage area as a source of income"* (Fennell, 2003). WWF has compiled goals of ecotourism, which of the most important are; All travel companies ought to appoint a person responsible for environmental questions, tourism shall be ruled by respect for the ecological and social carrying capacity, environmentally friendly hotels and knowledgeable guides are important, environmental guidelines, not only for tourist companies but also for suppliers at the site, contribution to local revenues, rigorous information to tourists to affect the attitude among travellers, contribution to local development and conservation (Emmelin, 1996).

Other types of tourism closely liked to, and therefore often mixed up with, ecotourism are nature tourism (biking, hiking etc), wildlife tourism (bird watching, fishing etc) and adventure tourism (climbing, kayaking, diving etc). Unlike these forms of tourism, ecotourism also involves conservation of the environment and benefits for local communities, as well as support for human rights. The aim is thus not only to provide recreational services but also finance conservation practices in sites that are particularly important in natural and cultural meaning, implement local economic development and provide foreign exchange (Brandon, 1996; Rubinstein *et al*., year of printing unknown). Ecotourism is a tool to raise interest and knowledge in the local environment and communities at the site.

According to the Quebec Declaration, which was stated at the assembly of the International Year of Ecotourism in 2002, ecotourism provides nature based environmental education, minimal impact management and contribution to conservation and community benefits (Fennell, 2003). Now, according to the association to negative impacts on the environment, which was caused by ecotourism in the past, one uses the name sustainable tourism rather than ecotourism. Other synonyms for ecotourism are responsible tourism, conservation tourism and low-impact tourism (Honey, 1999).

Definitions of ecotourists are; persons, who respect, aim to benefit and want to establish further knowledge about, not only the environment, but also local societies (Honey, 1999).
According to TIES' statistical sheet, a typical eco tourist is 35-54 years of age, college graduated, prefers to travel for one or two weeks, is willing to spend more than the average traveller on the trip (26 percent are ready to spend $1 000-$1 500 per trip) and often travels as a couple (TIES no 2, 2003).

In an article of Brandon (1996), ecotourists are categorized in levels from hard core to casual. Hard core tourists are knowledgeable and aware of the environment e.g. students and scientists. Casual tourists join an ecotourism trip as a part of another journey. In between these extremes, dedicated and mainstream tourists appear. The tourists are further classified in hard or soft, depending on the physical challenges they are willing to expose themselves to during the voyage. The different categories of tourists variously affect the level and type of impacts and must therefore be considered when planning for ecotourism management.

2.3.2 The development of ecotourism

The definitions of tourism origin from the 1800s, when they appeared in the Oxford English dictionary. In the mid 1800s, railway tours for personal transport stated the early beginning of tourism development in Europe and the United states. Nevertheless, it was not until 1948, at the time the airplane was first introduced for transport of people on recreational trips that the international tourism commenced of bigger extent (Honey, 1999).

The first thoughts towards ecotourism were formed in the 1960s, in the "Guiding principle of responsible tourism" by Hetzer. The base of the concept was to minimize impacts on the environment, maximize benefits for both tourists and local communities and to respect local cultures at the origin (Duhá Buchsbaum, 2004). In the end of the 1970s and early 1980s, ecotourism was gradually developed among the fields of conservation, aid institutions, travel industry and governments of southern countries. Presumably, the driving force in the development was the growing discontent with the tourism industry (Honey, 1999).

The first definition of ecotourism arose in the 1980s. In 1983, Ceballos-Lascuráin defined ecotourism as *"travelling to relatively undisturbed or uncontaminated natural areas with the specific objective of studying, admiring, and enjoying the scenery and its wild plants and animals, as well as any existing cultural manifestations (both past and present) found in these areas"* (Fennell, 2003).
Continuously throughout the 1980s, organisations around the world begun to highlight the importance of local economies and cooperation with local societies in conservation and management of protected areas. This was stated in the IUCN World congress on National Parks in 1982. At that time, an interest in ecotourism as an alternative source of income arose in southern countries. They noticed that the revenues of ecotourism often exceeded the benefits from conventional land uses, such as agriculture, particularly in arid areas.

In the 1990s, ecotourism emerged popularity among travellers all around the globe. In 1992, the number of ecotourists was 463 million. That number increased rapidly and 1997, the amount of travellers reached 594 million, an expansion of 30 percent (Honey, 1999). Now, tourism is one of the world's largest employers, contributing to the employment of about 200 million people, or ten percent of the jobs, globally. Travel for tourism purposes will presumably have a growth rate of about 4.1 percent per year and contribute to 1.6 billion holiday-makers year 2020 (TIES no 1, 2003).

2.3.3 Benefits and Constrains

Ecotourism entices tourists, aware about environmental impacts of tourism and may likewise create an increasing awareness and involvement in conservation and environmental questions, by provision of information of environmental degradation caused by human activities (UNEP, 2002). One important aspect is the contribution to increasing interest in nature among the people who possess money and power. That interest will be of importance in the approach of legislations and receiving money, for the commencement of conservation projects, in a country and globally (Brandon, 1996).

However, one of the most important benefits, regarding ecotourism, is that it finances creation, protection and management; such as infrastructure, guides and administration of parks and reserves as well as deliver revenues for local communities. The profits mainly derive from entrance fees and taxes but incomes from rental of equipment and licence fees for hunting or fishing are not negligible. By combining the increasing revenues with involvement of local people, an improvement of environmental conservation, in terms of expansion of management and protection of sensitive areas, can be established (CBD, 2001-2005). To governments, revenues from ecotourism possibly appear as an appealing alternative to logging and thus implement to preservation of the forests. Additionally, the monetary incomes of ecotourism reduce the need of hunting and slash-and-burn agriculture among local communities (UNEP, 2002). Improved livelihood of the people in rural areas is conceivable by the construction of roads and other infrastructure, in addition to enlarged possibilities of recreation (Blom *et al*., 2004). Establishment of park fees in ecotourism areas may exclude regional people, who can not afford the entrance fees when visiting a park. Development of a system of higher entrance fees for foreign people than for local visitors will approve the availability to local people (Brandon, 1996).

Often, local governments and communities in the area of tourism are economically weak and thus perceive a disadvantage in competition with foreign companies, now that trade and foreign investments restrictions decrease. Today, between 55 and 90 percent of foreign revenues disappear from southern countries towards northern countries. Therefore, the goal of provision of revenues and increased livelihood for local societies can not be fulfilled (Honey, 1999)

Among the major threats to the local environment is unsustainable use of natural resources for accommodation and infrastructure. Areas of ecotourism are often particularly sensitive in terms of high biodiversity and remoteness. When trees are felled to provide space for hotels, roads and walking trails, reduction of biodiversity is achieved. That may result in land degradation, such as soil erosion, loss of organic matter, less macro porosity, reduced permeability and increased run off (UNEP, 2002). Trampling may cause loss of groundcover, less regeneration and changes in species composition. Therefore, careful planning is essential before construction of bridges, hiking trails and roads (CBD, 2001 - 2005). A common feature in the tourist business is overuse of fresh water for personal use, golf courses and swimming pools. Consequently, it contributes to water shortage and a high amount of sewage, which causes eutropication of lakes, releases pathogens into the water and affects salinity of coastal waters (CBD, 2001 - 2005).

In 1996, 594 million persons were transported by international air transport. That is an increase from 88 million in 1972. By 2020, this number is expected to rise to 1,6 billion.

Tourism contributes to more than 60 % of all air transports and is likewise the fastest growing source of gas emissions (UNEP, 2002).

2.4 Potential for development of ecotourism in Nicaragua

2.4.1 Economy of Nicaragua

Nicaragua is the largest country in Central America and posses big environmental resources, such as Lago de Nicaragua, the largest source of freshwater in Central America. Despite that, the country is one of the poorest in the world, with low GDP and a high debt burden. The unemployment is prevailing (12 percent of the general population and 21 percent amongst poor women, according to measurements in 1998) and the level of wages is one of the worlds most unequal (the top ten percent of the country had 19 times higher income than the poorest 40 percent of the population in 1998). The past years, the political and economical situation in Nicaragua has stabilised but yet the country is dependent on foreign economic aid. In 2004, a debt reduction of $45 billion was initiated by Heavily Indebted Poor Countries (HIPC) for Nicaragua's efforts in stabilising the economy of the country (CIA, 2006; Government of Nicaragua, 2001). The livelihood of the people is far below global standards, with 72,6 percent of the population in poverty according to UBN[2] measurements made in 1998. 35 percent of the population has not satisfying water access and 16 percent has no access to clean water at all. In 1998, 57 percent of the population had no electricity and 97 percent did only use firewood for cooking (Government of Nicaragua, 2001).

As pointed out in Table 1, 30,5 percent of the inhabitants are farmers, growing mainly coffee, bananas, sugarcane, rice, corn, cotton, tobacco, sesame seeds, soy beans and beans but also performance of cattle ranching or shrimp and lobster farming is common. The industry, which employs 17,3 percent of the citizens, are based on food processing, machinery and metal products, chemicals, textiles and clothing, petroleum refining, beverages, footwear and wood. The remaining 56 percent of the working citizens are employed in the service sector, amongst which tourism is a section (CIA, 2006). In 1998, tourism was the third most important source of foreign revenues in Nicaragua (a yearly amount of $90 million). At that time, 381 600 tourists visited Nicaragua, a number that is expected to increase dramatically in the next years (U.S. Department of state, 2000).

[2] UBN (Unsatisfied Basic Needs) surveys are based on measurements of whether the basic needs of the population of study are met. The basic needs evaluated are based on indicators, such as infrastructure (even social infrastructure) and social services (education and health) that are necessary to satisfy the livelihood of the population. What exactly those needs are and the threshold, below which they can not be fulfilled, is determined during the survey. Further, a measurement scale is defined and an index of the basic needs is calculated (Abaleron, 1995).

Table 1: *Facts of Nicaragua (CIA, 2006; Croes & Tesone, 2004)*

Area (km^2)	129 494
Climate	Tropical, cooler in the highlands
Population	5 570 129
Population growth (%)	1.89
Recourses	Gold, silver, copper, lead, zinc, timber, fish
Main environmental hazards	Deforestation, soil erosion and water pollution
Labouring sektors (%)	Agriculture: 30.5 Industry: 17.3 Services: 52.2
GDP per capita (US$)	2 900 million
Yearly income per capita (US$)	489

2.4.2 Natural resources and indigenous people

Among Nicaragua's most important resources are the natural reserves. The 129 494 km^2 sized country contains 76 reserves and parks, which cover more than 20 000 km^2. Encompassing more than 1 400 species of animals and an estimation of 12 000 different plants, Nicaragua is one of the top countries, in terms of high biodiversity. Despite the many natural reserves, the deforestation in the country is alarming; about 150 000 hectares of forest disappear every year, especially in León and Chinandega, on the Nicaraguan west cost. By Lake Nicaragua, fish farms create about 40 tons of waste per day, which is washed out into the lake without treatment (Reid *et al.*, 2004). Many of the protected areas are privately owned and poorly managed and are therefore not yet suitable for tourism.

The largest amount of pristine forests in the country is situated by the Nicaraguan east coast, which is also the most unpopulated part (only 10,7 % of the population live there). The area is divided into two regions, the RAAN (Región Autónoma del Atlántico Norte) and the RAAS (Región Autónoma del Atlántico Sur), together covering one third of the country. The majority of the people here are indigenous, living mainly of fishing or horticulture. The population of RAAN are 50 % Mestizo, 45 % Miskitu, 2 % Mayangna and 2 % Creole. In RAAS was 54 % Mestizo, 30 % Creole, 11,6 % Mayangna, 0,7 % Garifuna, 0,7 % Rama and 0,2 % other ethnic groups in 1995. Among the most numerous of the indigenous groups in Nicaragua are the Miskitus; coastal Indians, mainly performing fishing and horticulture. Another large group is the Mastizos (constitutes of 46,2 % of the population by the Atlantic coast), an English-Miskitu speaking people who mainly earn their living as farmers. Mayangas, the native Indian people that live along the rivers, are nowadays mostly Spanish speaking. The Mayanga population contains three groups with different, but related, languages; the Twahka, the Ulwa and the Panamaka. The ancestors of the African and European people that settled in Nicaragua about 400 years ago are called Creoles. Their main language is English but also Spanish is spoken. Garifuna and Raman people has abandoned their language and nowadays, the majority speak English (Jamieson, 1999).

2.4.3 Planning and management of ecotourism

An important tool in management of tourism in conservation areas is establishment of zones of different needs of protection. In identification of the zones, results from ecological research (sensitivity of the species in the area) have to be considered, together with the goals of protection, type of use and economical conditions. In some areas, e.g. breeding grounds, no tourism can be allowed at certain parts of the year; thus a sanctuary zone is created to protect the nature. In conservation zones, use is permitted after regulations of number of tourists and focus on preservation. Recreation zones are created where medium-scaled tourism is present and does not disturb essential habitats and species to a big extent. Development areas are zones where attractions and buildings for tourist purposes are centred (Brandon, 1996; Fennell & Dowling, 2003).

A holistic view upon ecotourism is essential to reach sustainability. Biological approach of biodiversity and understanding of human impact e.g. high densities of tourists in sensitive areas may change the behaviour of animals or introduce foreign diseases, is the base of sustainability. However, consideration of local economy and benefits and constrains for local societies and cultures are essential parts of the management (Fennell & Dowling, 2003).

CHAPTER 3

The study site

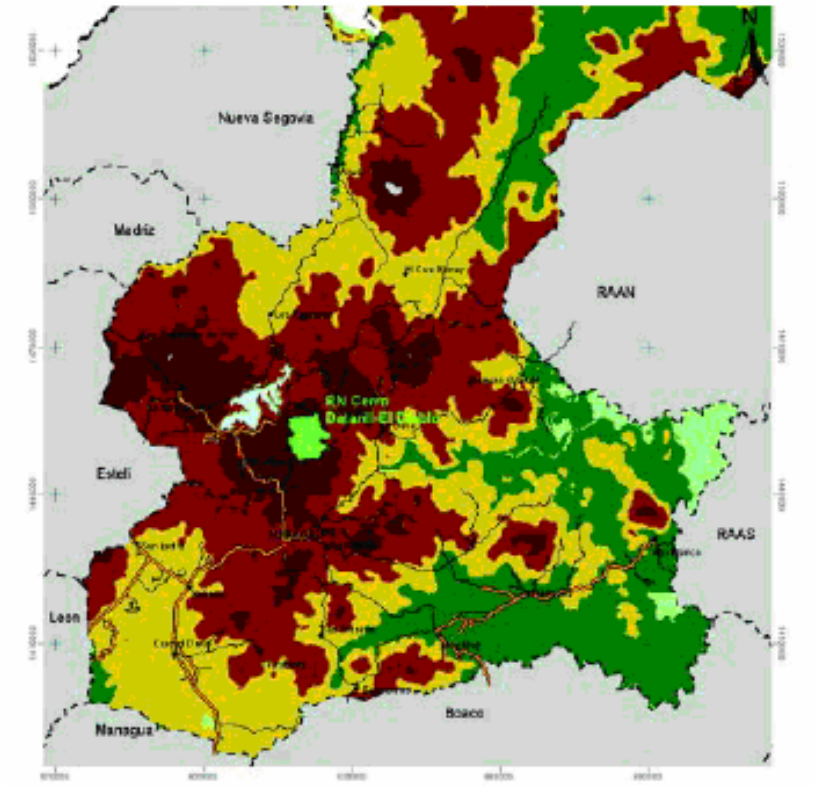

Figure 1: *Map of Jinotega county. The study site is marked in light green (Camacho Bonilla et al., 2002).*

3.1 Geology

Datanlí – El Diablo natural reserve is located between the cities of Matagalpa (south of the reserve) and Jinotega (western part of Datanlí), in the north of Nicaragua. In the north, the reserve enters lake Apanás and in the east, Tuma river (Fig. 1). The mountain, on which the reserve is created, is a part of a volcanic plateau that is formed by basalt-rich lava (MARENA – PROTIERRA – CBA, accessed 2006).
The reserve is constituted by mostly cloud forest due to the high altitude (900 m – 1 650 m), with most of the forest located above 1 200 m. The area of the natural reserve has a 58 percent forest cover (3 400 ha). 49 percent of the reserve is constituted by dense forest and nine percent by open forest. Due to satellite pictures, the forest is fragmented to different degrees. Most of the fragmentation is presumably an affect of the hurricane Mitch, that stroke Nicaragua in October 1998. Three patches with dense forest is located in the north, west and south of the reserve (Camacho Bonilla *et al.*, 2002)

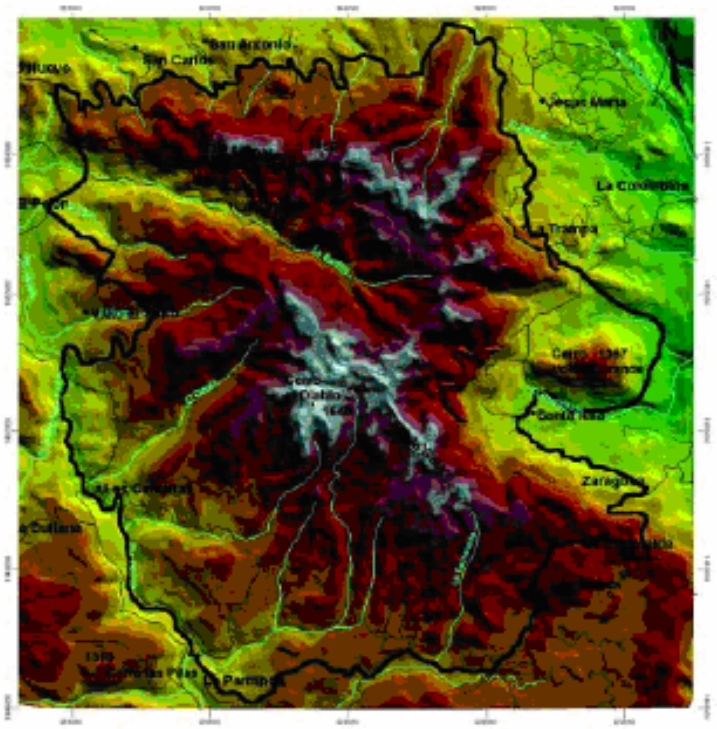

Figure 2: *Map of the borders and altitude levels of the natural reserve (Camacho Bonilla et al., 2002).*

3.2 Climate

The climate in Nicaragua is tropical, constituting of one rainy season (May until October) and one dry season (November to April). The warmest season is March to May and the coldest month is December.

Due to the high altitude, Datanlí – El Diablo has a slightly lower temperature than the rest of the country. Average in December to February (the coldest months) is 14° – 24° C in the lowest parts and 12,5° - 15° C above 1 000 m of altitude. In April to July (the warmest months), the average reaches 17° - 27° C.
Precipitation is high in the area; 1 650 mm per year normally. The monthly number average from 5 mm to 46 mm between December and April, and between 145 mm and 305 mm, in May to November, according to data from 2006 (BBC, 2006; Camacho Bonilla *et al.*, 2002).

3.3 History and land use

The idea to create a natural reserve in the area developed in 1991, with the main goal to preserve the tropical forests. In 2003, the association PAGJINO (Proyecto Aldea Global Jinotega) published a management plan combined with GPS measurements, for potential ecotourism activities and zonation of the area (Laguna Dávita & Somarriba Chang, 2005). In late 2005 and early 2006, cabins were built to provide ecotourism activities in the reserve. Now, in late 2006, small scale ecotourism practices have begun, with mostly students and scientists visiting the area.

The main land use, even inside the reserve, is coffee plantings, often combined with cultivation of banana in agroforestry systems. In the lower parts of the reserve, production of

vegetables and pasture land is abundant (Fig. 3). The products from the agriculture are mostly sold locally, in the cities of Matagalpa and Jinotega. Due to the high costs of transportation in Nicaragua, distribution to other parts of Nicaragua is rare (Camacho Bonilla *et al.*, 2002).
About 90 percent of the area is considered to be private property, constituting mostly agriculture and pasture land. Among the ten percent owned by the state, big parts correspond to rivers and roads. The reserve is managed by MARENA, which is located in the cities of Matagalpa and Jinotega. No managers are present in the reserve (MARENA – PROTIERRA – CBA, accessed 2006).

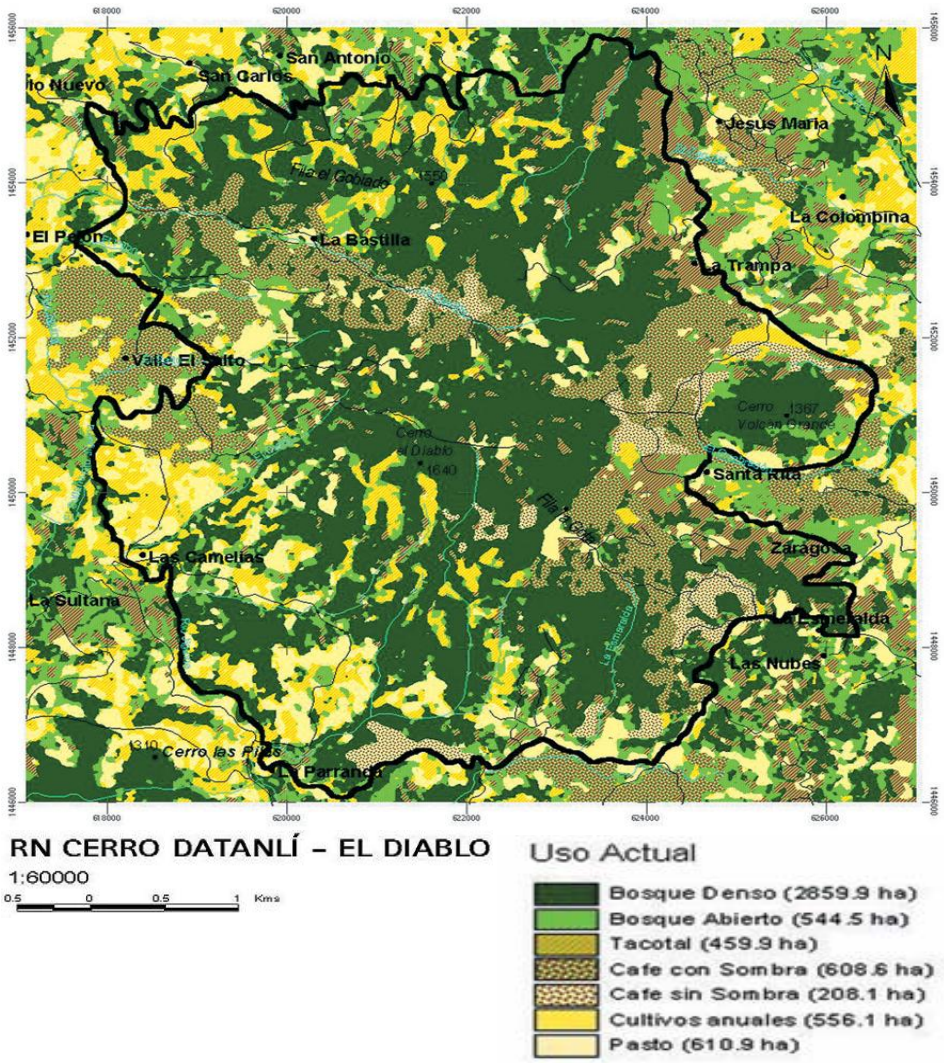

Figure 3: *Present land use in the study area (Camacho Bonilla et al., 2002)*[3].

[3] Bosque denso = Dense forest
Bosque abierto = Open forest
Tacotal = Fallow land
Café con sombre = Shaded coffee
Café sin sombre = Coffee in open areas
Cultivos annuals = Annual crops
Pasto = Pasture land

CHAPTER 4

Methods

4.1 Methods used in the fieldwork

Inventories of herbs, mosses, epiphytes, trees and shrubs were conducted using belt transect surveys. The surveys took place in natural reserve Datanlí – El Diablo, Nicaragua, an area where small scale tourism is recently established.
Along two walking trails in the natural reserve, belt transects were conducted in right angels out from the trails with a joint distance of 100 m between each transect for the 700 m short trail (Campanero) and 200 m for the 2 300 m long trail (Léon). By flipping a coin, randomisation of the right-left orientation for the first transect was constructed.
In a row along each transect, 5 squares of 2*2m size for estimation of herbs, mosses, epiphytes and shrubs below 1,5 m of height was placed. The last square in each transect was used as a reference. For measurements of trees and tall shrubs, 2 square plots of 10*10 meters each, were laid out along each transect.

Herbs, epiphytes and shrubs (woody species up to 1,5 meters and woody species with more than one stem), were investigated using measurements of number of species and richness records of number of stems in each square. Mosses on ground level were estimated by number of species and percentage coverage in the different squares. The measure of percentage coverage were, according to BIN Vegetation (Naturvårdsverket, 1989), made by estimation of the ground cover inside the squares, caused by each species, independent of whether the plants are rooted inside or outside the squares. Hult-Sernander - Du Rietz' range of degree of coverage was used in the classification (Naturvårdsverket, 1989) (Table 2).

Table 2. *Hult-Sernander-Du Rietz' 5 – leveled scale of coverage (translated into English from Naturvårdsverket, 1989).*

Class	Coverage	Width of the class	Median of the class	Percentage coverage of the median
1	Less than 1/16 of the square	0 – 2/32	1/2	3.1
2	1/16 – 1/8 of the square	2/32 – 4/32	3/32	9.4
3	1/8 – 1/4 of the square	4/32 – 8/32	6/32	18.8
4	1/4 – 1/2 of the square	8/32 – 16/32	12/32	37.5
5	More than 1/2 of the square	16/32 – 32/32	24/32	75.0

When possible, determination of scientific name and common name was conducted as well as the major use for all species.

Development of ecotourism in the natural reserve is relatively recent and minimum modifications of the area around the walking trails have been conducted. According to that, assumptions of epiphytes and stranglers above 1,5 m of height from the ground as minimally influenced by tourists could be drawn. Thus, they were not investigated.

Inventories of epiphytes to the height of 1,5 m from ground level were made, using measurements of number of species and richness records of number of stems.

For the identification of species to common names, the help of a local farmer with good knowledge of the area was used. Scientific names were identified at the university after the field survey.

4.2 Calculations

To arrange the data and create an overview of the changes in biodiversity, the diversity index of Edward Hugh Simpson (1949) was calculated for each plot. This was achieved by calculations of the amount of stems in the plots, using the equation below. The index points out the probability of two randomly chosen samples in the study site to belong to the same species. The index not only describes the amount of species in the community but also the composition of species. A diversity index close to 1 shows a low biodiversity and an index close to 0 points out a high biodiversity (Gaten, 2005). To see the variation of $D_{Simpsons}$, i.e. the distribution of species within the plots, the evenness (E_p), was calculated, using the equation below. Evenness close to one indicates high distribution of species and a number close to zero points out no equability in the plot.

$$\mathbf{D_{Simpsons} = \Sigma\ (N_i/N_{tot})^2} \qquad \mathbf{E_p = D_{Simpsons} / D_{max}}$$

N_i = stems of a certain species
N_{tot} = total number of stems in the study site
D_{max} = total number of species

4.2.1 Statistics

Statistic interference was calculated to draw conclusions about the populations, by using systematic samples. Continuously, quantitative analysis of number of species in each plot, and number of plants within each plant group, were carried out during the survey.

H_0 = Zero hypothesis. No change in the plots close the trail relative reference plots.

H_1 = Hypothesis of investigation. Ecotourism in Nicaragua affects the vegetation and reduces the number of species, as well as number of stems in the study site.

Arithmetic mean value:

$$\mathbf{x_{mean} = \sum x_i/n}$$

x_i = number of species/stems
n = number of transects

Variation:

$$\mathbf{s^2 = \sqrt{(1/(n-1))} * \Sigma(x_i - x_{mean})^2}$$

Standard deviation:

$$s = \sqrt{s^2}$$

Unpaired t-test was used to test the similarities in the two mean values for trees and tall shrubs. Unpaired t-test is used when all the groups in the study belongs to the same population.

$$t = (x_{mean\ 1} - x_{mean\ 2}) / SE_{diff}$$

$$SE_{diff} = \sqrt{(s^2_{1,2}/n_1) + (s^2_{1,2}/n_2)}$$

$$s^2_{1,2} = ((n_1 - 1) * s^2_1 + (n_2 - 1) * s^2_2) / ((n_1 - 1) + (n_2 - 1))$$

T-test values bigger than the critical value (from a t-test table, F(t)= 0,95) → reject H_0, i.e. significant change.

The significance of the variations of herbs, low shrubs and epiphytes was investigated in a linear regression. The P-value (probability value) and r^2 (determination coefficient) were calculated to indicate the correlation between distance from the path and change in species.

P-values lower than 0,05 → reject H_0, i.e. significant change
Both P-values and r lower than 0,05 → no correlation

Table 3: *The strength of r, low r → no correlation (Translated into English from Grandin, 2002).*

Correlation coefficient, r	Strength
0 to 0,19	Very weak
0,20 to 0,39	Weak
0,40 to 0,69	Medium
0,70 to 0,89	Strong
0,90 to 1	Very strong

4.2.2 Graphs and tables

The number of species was summed up in a frequency table for each plant type, containing mean value, standard deviation, diversity index and equalibility (evenness). Plotted curves show the frequency of herbs, low shrubs and epiphytes for the different distances. Histograms show the frequency of trees and tall shrubs in the plots of investigation relatively reference plots.
Additionally tables were created for number of stems for each plant type, containing mean value and standard deviation for each distance from the trail. Plotted curves show number of stems for herbs, low shrubs and epiphytes for the different distances. Histograms show number of stems for trees and tall shrubs in the plots of investigation compared to the reference plots.

4.3 Evaluation of the methods

Before starting the field survey, the plan was to use three big plots for measurements of trees and tall shrubs. It was difficult and time consuming to enter the forest to 30 m, due to the dense vegetation and the sloping ground. By reasons to that, in combination with difficulties to create transects that were not affected from more than one side, the number of big plots was changed to two. The second plot (10 - 20 m) could still be used as a reference, because of the low impact on tall trees and shrubs in the area. The dense forest caused difficulties in establishment of even plots. Therefore, some of the plots were laid out in forms of rombs.

During the survey, I experienced difficulties in distinguishing gradients with impacts from only the front side (on plot and sub plot number 1), since the trail was winding.

The knowledge of a local farmer, who works in the reserve, was used for identification of species. That was a necessity since it would have been too time consuming to identify all species myself. Now, I received the species in common names and thus, the scientific names had to be identified afterwards. A bias regarding that methodology is, that the common names he is using, may be names of different species, in other parts of Nicaragua and central America. The scientific names found may therefore not always be correct.

Mosses were hard to distinguish to percentage coverage because of their distribution on fallen branches and rocks. The relative coverage between the plots is although the same.

To create an overview, and compare species diversity in a study area, diversity indices were calculated. The diversity indices most commonly used in vegetation inventories are Simpson's index and Shannon – Wiener's index. In the use of Shannon – Wiener's index, biases may occur in big sampling sizes. The indices are similar in other aspects. Therefore, I choose to use the Simpson's index for the calculations.

In statistic methods, either mean error or standard deviations can be used to state the significance of the results. The standard deviation describes the variation in the sample and is usually used in field surveys of natural variation. The mean error describes the rate of equality between the sample and the population, and is often used in controlled experiments (Grandin, 2002). Therefore, the standard deviation was used in this survey.

4.4 Material

The material used for the literature review, required for preparation of the field study, was books and articles regarding ecotourism, statistics and survey methods, floras, available data from earlier surveys and information from websites on the internet.
For the field surveys, I used map, tape measures, marking sticks, tape for marking, compasses, GPS, slope measure meter, protocol, notebook and pencil.

CHAPTER 5

Results

5.1 Tables and graphs

The results of the inventories in both areas did not show any significant changes in neither species richness nor composition for the two walking trails. Small changes are spotted in the graphs and tables but the result of the t-test and regressions show no significance. High standard deviations are present in all calculations and indicate high variation between the transects.

5.1.1 Number of species and diversity indices for the species in trail Léon.

Diversity is high in all plots and slightly higher in the reference plot compared to the plot closest to the trail. Distribution of trees is higher in the plot closest to the trail (Table 4; Fig. 4)

Table 4: *Number of species of trees in the plots in Léon.*

Distance from path (m)	Mean value	Standard deviation	$D_{Simpsons}$	E_p
0-10	6	2,1	0,00400	0,000083
10-20	6	1,6	0,00231	0,000048

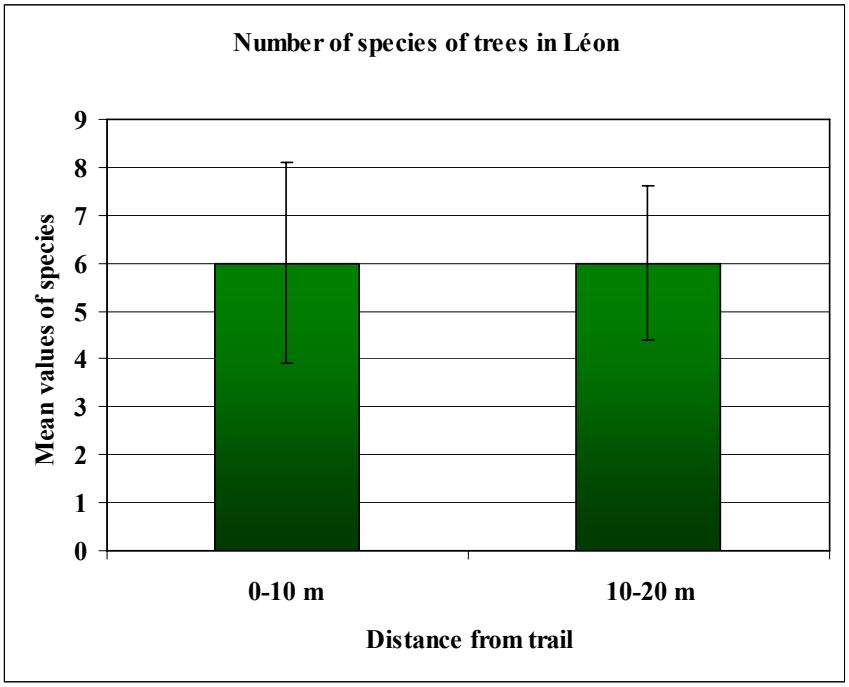

Figure 4: *Mean value of number of species for trees from the two plots in walking trail Léon.*

The low values of diversity indices of tall shrubs in trail Léon, indicates a great diversity in this forest. Diversity is slightly higher in the plot of investigation compared to the reference. However, equability is higher in the reference plot (Table 5).

Table 5: *Number of species of tall shrubs in the plots in Léon.*

Distance from path (m)	Mean value	Standard deviation	$D_{Simpsons}$	E_p
0-10	1	1,2	0,00273	0,000171
10-20	2	1,1	0,00894	0,000559

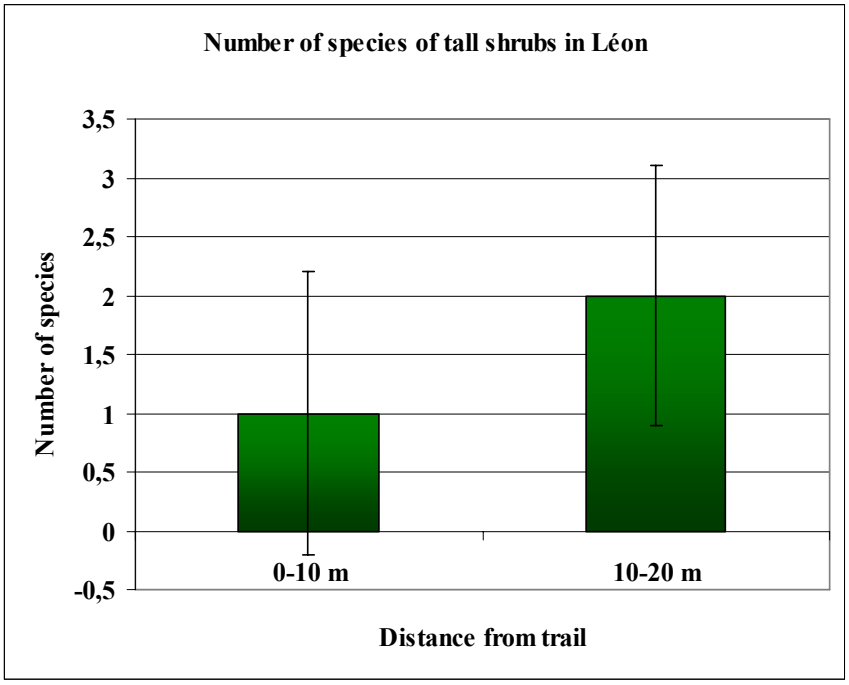

Figure 5: *Mean value of number of species for tall shrubs from the two plots in walking trail Léon.*

The diversity of herbs is lowest in the plot closest to the trail (0-2 m) and highest at a distance of 6-8 m. Equability is high where the diversity is low (Table 6).

Table 6: *Number of species of herbs in the sub plots in Léon.*

Distance from path (m)	Mean value	Standard deviation	$D_{Simpsons}$	E_p
0-2	2	0,9	0,00118	0,000036
2-4	2	0,7	0,00056	0,000017
4-6	2	1,1	0,00038	0,000012
6-8	2	0,9	0,00033	0,000010
8-10	2	0,8	0,00085	0,000026

The mean values in number of species for low shrubs are all equal. Diversity and distribution varies unsystematically among the plots (Table 7).

Table 7: *Number of species of low shrubs in the sub plots in Léon.*

Distance from path (m)	Mean value	Standard deviation	$D_{Simpsons}$	E_p
0-2	2	1,0	0,00040	0,000013
2-4	2	1,2	0,00023	0,000077
4-6	2	1,1	0,00016	0,000053
6-8	2	1,5	0,00075	0,000025
8-10	2	1,5	0,00086	0,000029

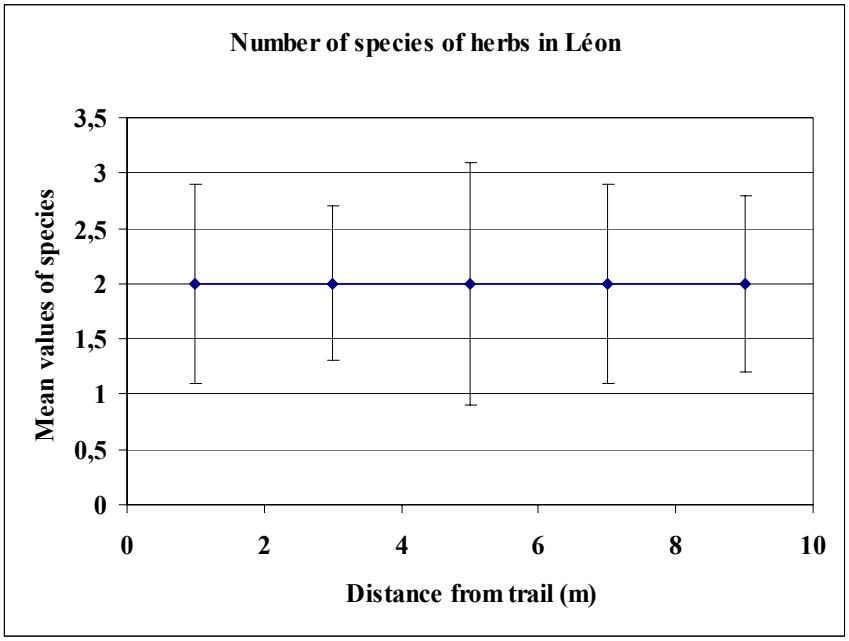

Figure 6: *Mean value of number of species for herbs from the five plots in trail Léon.*

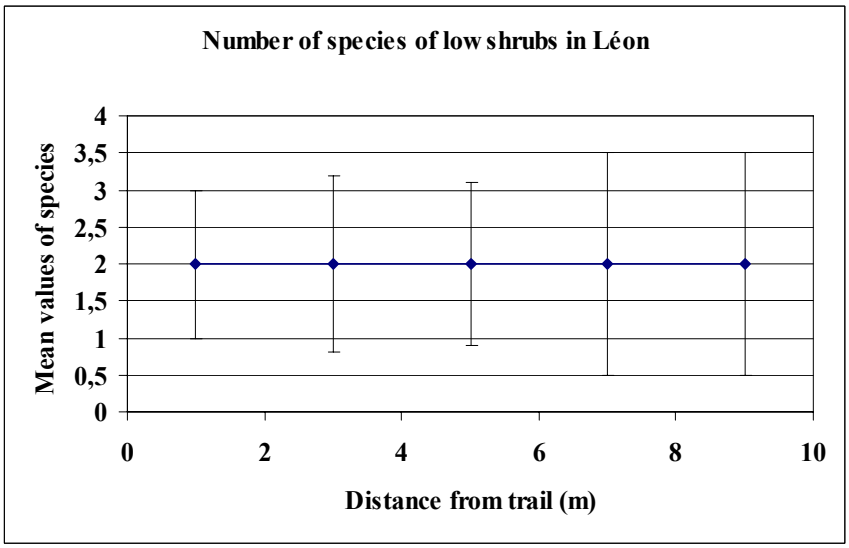

Figure 7: *Mean value of number of species for shrubs from the five plots in trail Léon.*

5.1.2 Number of stems for the plant types in walking trail Léon.

Table 8: *Number of stems of trees for the plots in trail Léon.*

Distance from path (m)	Mean value of stems	Standard deviation
0-10	14	15,3
10-20	16	10,5

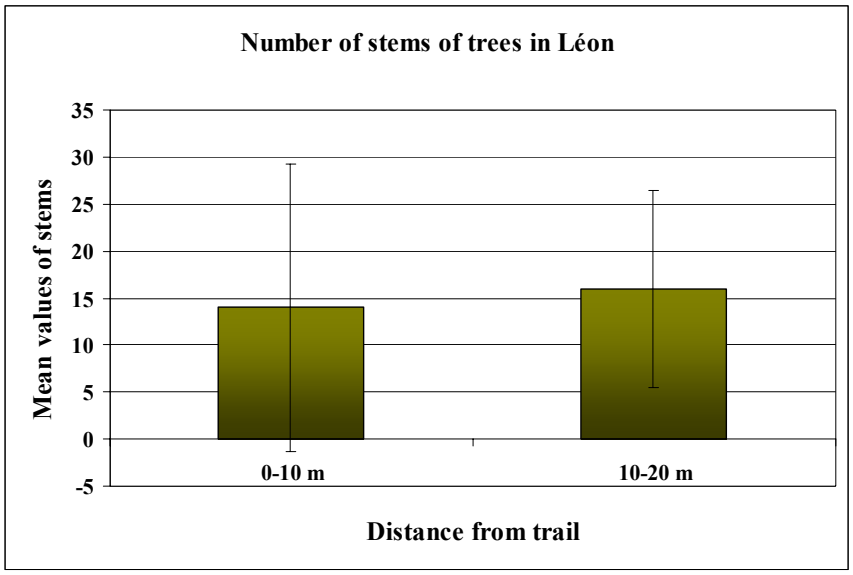

Figure 8: *Mean value of number of stems for trees in the two plots.*

Small changes in number of stems of tall shrubs. High standard deviations illustrate the diversity of the different transects (Table 9).

Table 9: *Number of stems of tall shrubs for the plots in trail Léon.*

Distance from path (m)	Mean value of stems	Standard deviation
0-10	3	7,0
10-20	7	6,5

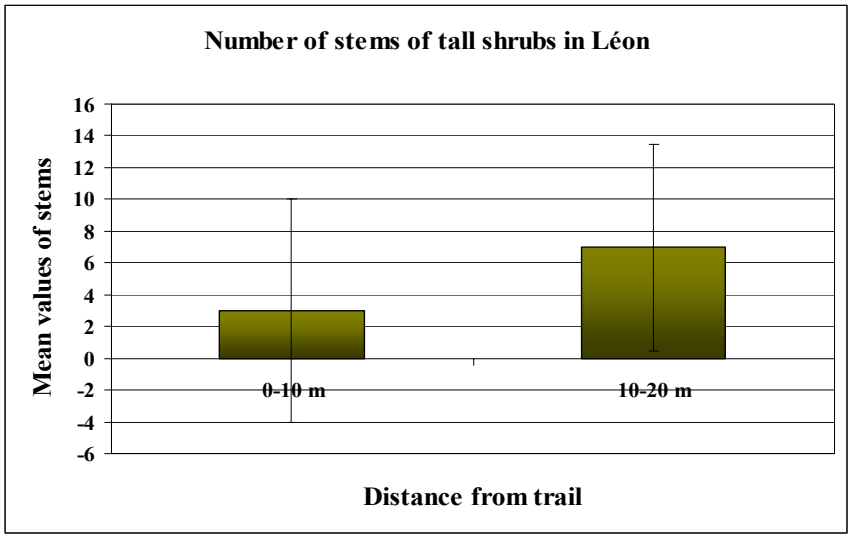

Figure 9: *Mean value of number of stems for tall shrubs in the two plots in trail Léon.*

Number of stems of herbs in Léon varies randomly between the different plots. Very low correlation due to low r-value (Table 10; Appendix 6).

Table 10: *Number of stems of herbs for the plots in trail Léon.*

Distance from path (m)	Mean value of stems	Standard deviation
0-2	17	22,6
2-4	12	15,8
4-6	11	10,0
6-8	9	8,2
8-10	17	17,8

Table 11: *Number of stems of epiphytes for the plots in trail Léon.*

Distance from path (m)	Mean value of stems	Standard deviation
0-2	1	2,3
2-4	1	1,4
4-6	1	0,8
6-8	1	1,5
8-10	4	6,4

Slightly more stems of low shrubs in plot number four and five (6-8 m and 8-10 m). High standard deviations and medium correlation due to the value of r (Table 12; Appendix 6)

Table 12: *Number of stems of low shrubs for the plots in trail Léon.*

Distance from path (m)	Mean value of stems	Standard deviation
0-2	6	5,7
2-4	5	3,7
4-6	1	2,8
6-8	8	7,1
8-10	9	7,5

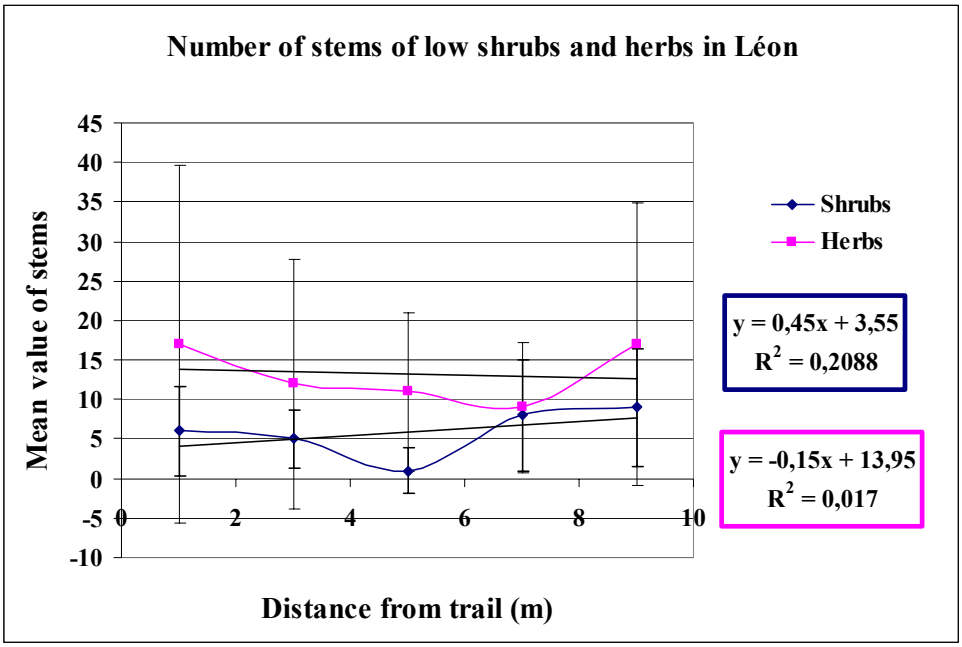

Figure 10: *Mean values for number of stems for shrubs and herbs in the five plots.*

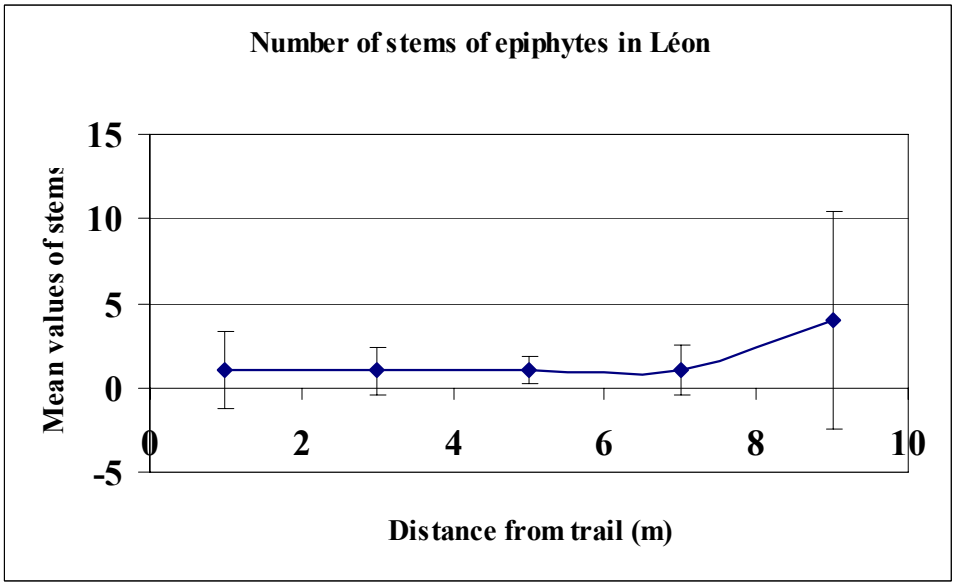

Figure 11: *Mean values for number of stems for epiphytes in the five plots.*

5.1.3 Number of species and diversity indices for the species in trail Campanero

Table 13: *Number of species of trees in the plots in Campanero.*

Distance from path (m)	Mean value	Standard deviation	$D_{Simpsons}$	E_p
0-10	6	1,7	0,00165	0,000052
10-20	7	1,3	0,00229	0,000071

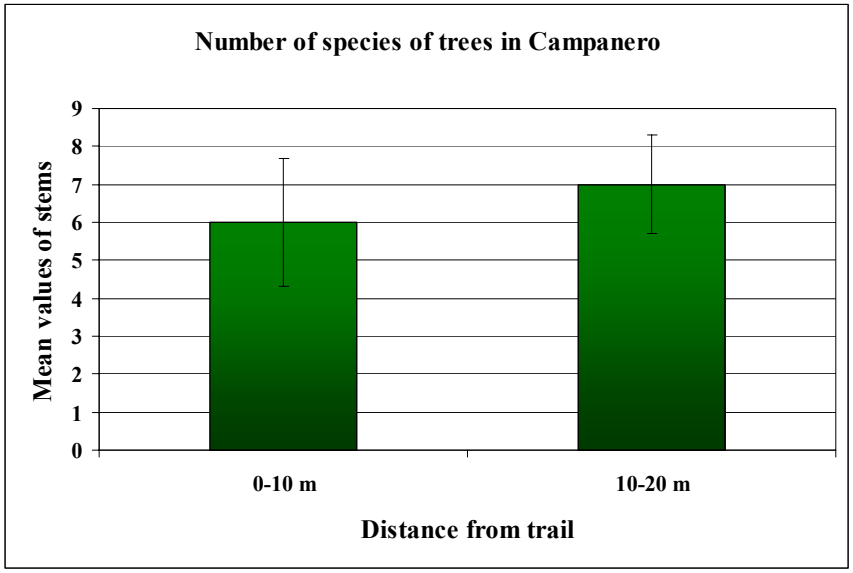

Figure 12: *Mean values for number of species of trees in the two plots.*

Diversity of tall shrubs is lower in the reference plot and distribution is lower in the plot of investigation (Table 14).

Table 14: *Number of species of tall shrubs in the sub plots in Campanero.*

Distance from path (m)	Mean value	Standard deviation	$D_{Simpsons}$	E_p
0-10	2	1,5	0,09463	0,008600
10-20	3	1,1	0,00907	0,000824

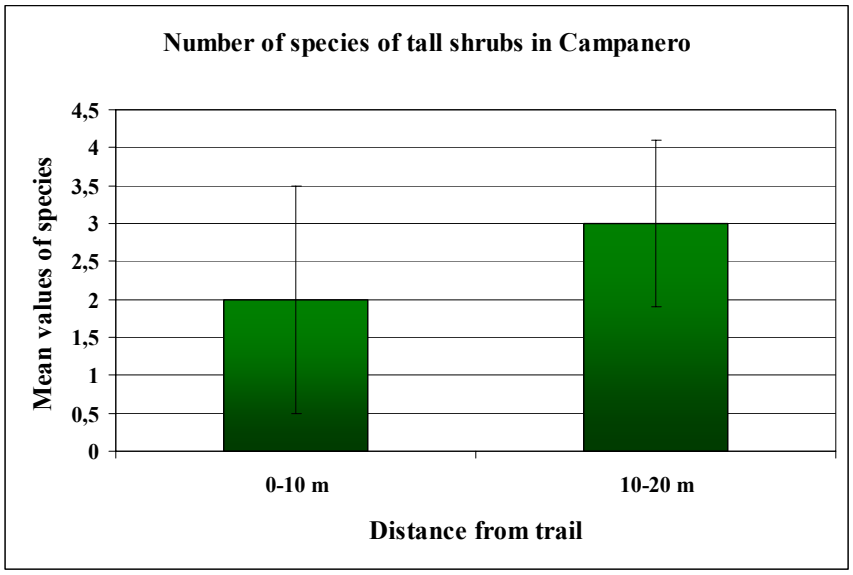

Figure 13: *Mean value for number of species of tall shrubs in the two plots.*

Small and randomly distributed variations of herbs (Table 15). Low correlation due to low r-value (Appendix 6).

Table 15: *Number of species of herbs in the sub plots in Campanero.*

Distance from path (m)	Mean value	Standard deviation	$D_{Simpsons}$	E_p
0-2	2	0,9	0,00182	0,000228
2-4	1	0,5	0,00375	0,000469
4-6	1	0,5	0,00415	0,000519
6-8	2	1,0	0,00065	0,000081
8-10	2	0,7	0,00106	0,000133

Low correlation of species of epiphytes (Table 16; Appendix 6).

Table 16: *Number of species of epiphytes in the sub plots in Campanero.*

Distance from path (m)	Mean value	Standard deviation	$D_{Simpsons}$	E_p
0-2	0	-	-	-
2-4	1	0,6	0,00138	0,000690
4-6	1	0,3	0,00727	0,003635
6-8	0	-	-	-
8-10	1	0,4	0,00565	0,002825

Slightly lower diversity of low shrubs is spotted in plot number one (0-2 m). Medium correlation (Table 17; Appendix 6)

Table 17: *Number of species of low shrubs in the sub plots in Campanero.*

Distance from path (m)	Mean value	Standard deviation	$D_{Simpsons}$	E_p
0-2	4	3,2	0,00117	0,000038
2-4	3	2,3	0,00088	0,000028
4-6	3	2,0	0,00024	0,000077
6-8	2	1,4	0,00075	0,000024
8-10	3	1,8	0,00039	0,000013

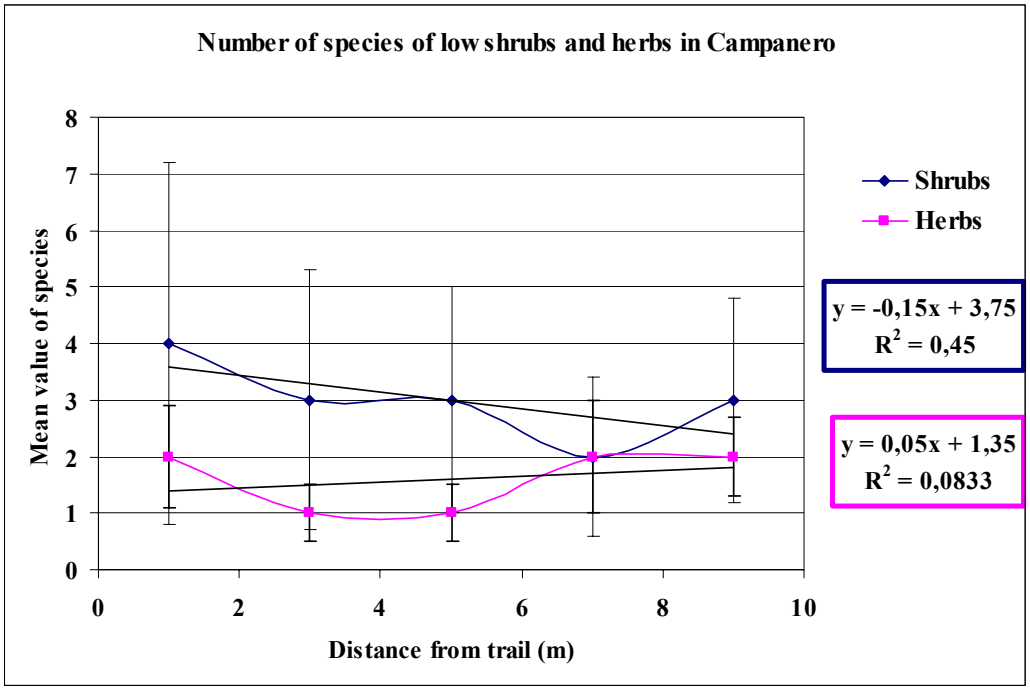

Figure 14: *Mean value for number of species of shrubs and herbs in the five plots.*

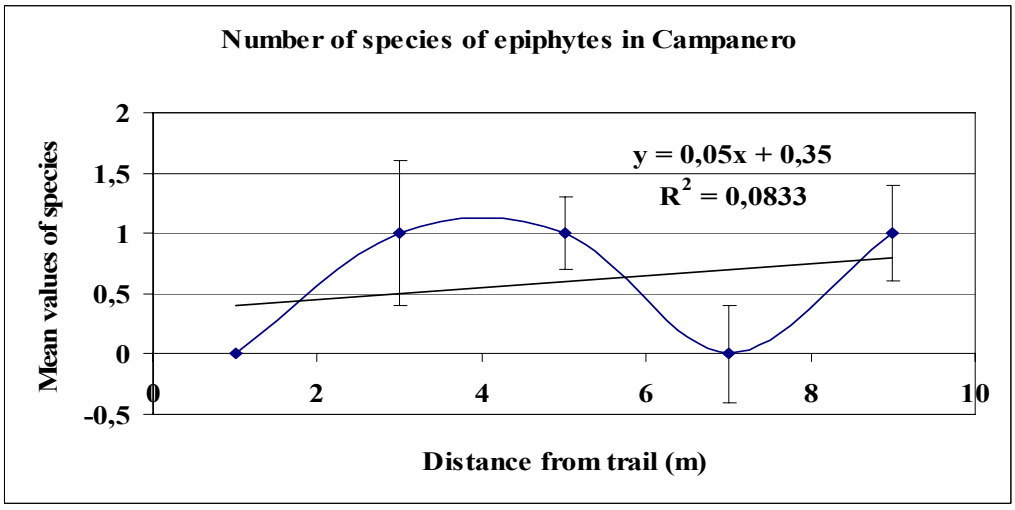

Figure 15: *Mean value for number of species of epiphytes in the five plots.*

5.1.4 Number of stems for the plant types in walking trail Campanero

Table 18: *Number of stems of trees for the plots in trail Campanero.*

Distance from path (m)	Mean value of stems	Standard deviation
0-10	14	9,3
10-20	17	5,8

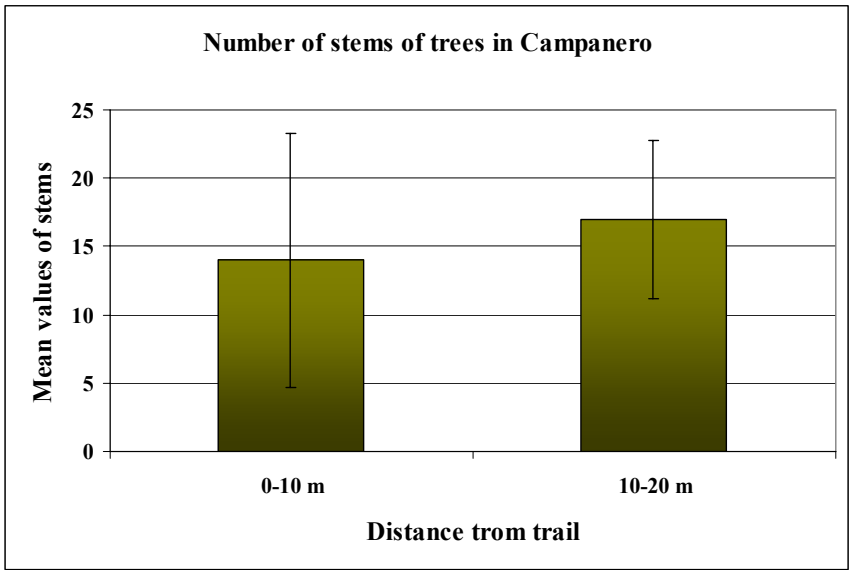

Figure 16: *Mean values for number of stems of trees in the two plots in walking trail Campanero.*

Higher amount of species for tall shrubs appears in the reference plot compared to the plot closest to trail Campanero (Table 19; Appendix 5).

Table 19: *Number of stems of tall shrubs for the plots in trail Campanero.*

Distance from path (m)	Mean value of stems	Standard deviation
0-10	2	2,0
10-20	8	6,3

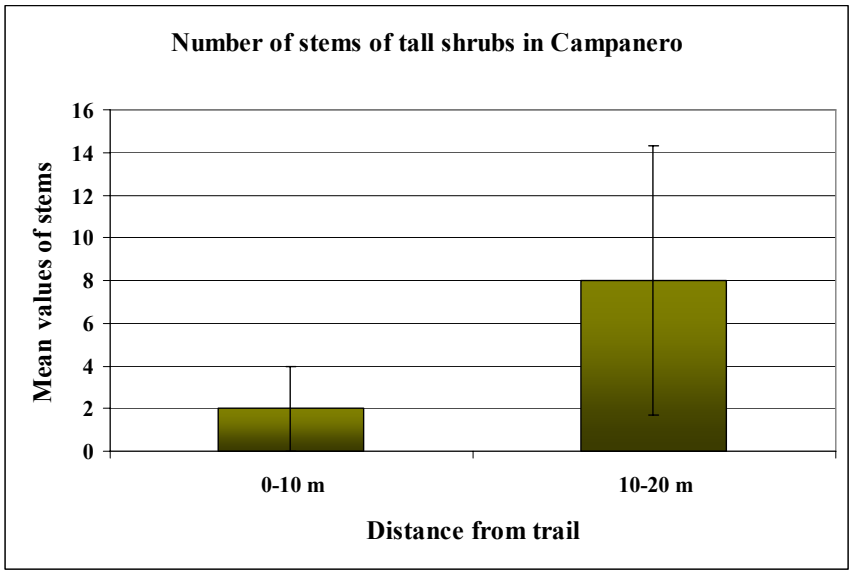

Figure 17: *Mean values for number of stems of tall shrubs in the two plots.*

Randomly distributed fluctuations in number of stems of herbs. High standard deviations. Low r-value and thus low correlation (Table 20; Appendix 6).

Table 20: *Number of stems of herbs for the plots in trail Campanero.*

Distance from path (m)	Mean value of stems	Standard deviation
0-2	13	18,8
2-4	15	21,7
4-6	19	19,0
6-8	11	10,6
8-10	11	12,1

Table 21: *Number of stems of epiphytes for the plots in trail Campanero.*

Distance from path (m)	Mean value of stems	Standard deviation
0-2	0	-
2-4	1	1,2
4-6	2	2,1
6-8	1	1,6
8-10	2	1,8

Number of stems of low shrubs is higher in plot number one (0-2 m). High correlation (Table 22; Appendix 6)

Table 22: *Number of stems of low shrubs for the plots in trail Campanero.*

Distance from path (m)	Mean value of stems	Standard deviation
0-2	10	8,1
2-4	8	4,9
4-6	4	2,2
6-8	5	6,0
8-10	5	4,0

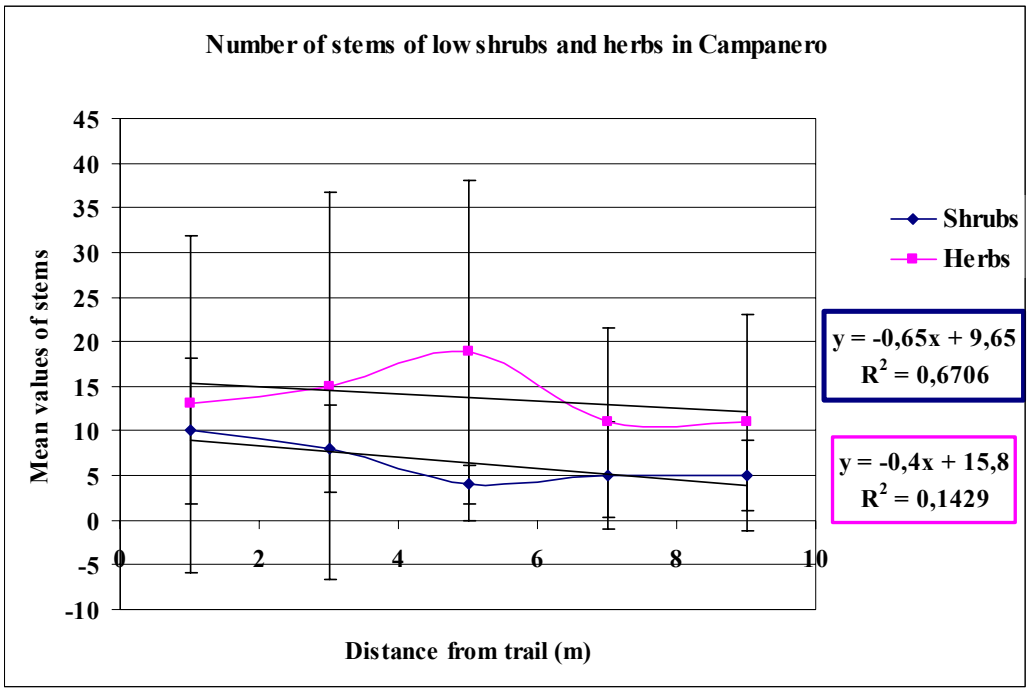

Figure 18: *Mean values for number of stems of shrubs and herbs in the five plots.*

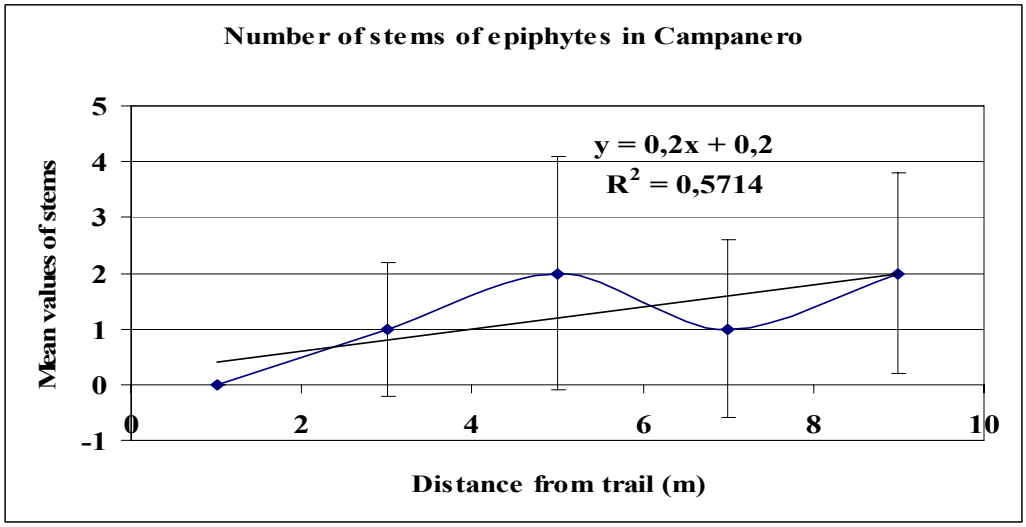

Figure 19: *Mean values for number of stems of epiphytes in the five plots.*

CHAPTER 6

Discussion

6.1 Structure and dynamics in Datanlí

The ground cover in a cloud forest is highly sensitive to changes in light due to the constant shading from the dense canopy roof. The normal amount of light, reaching the forest floor of tropical forests, is 0,5 - 2,0 percent of the light above the canopy roof (Kellman & Tacaberry, 1997). Therefore, the lower layers of the vegetation in these forests are often less dense than the lower layers in temperate forests.

Construction of trails creates a gap above to the trail, in which light is more abundant. Due to this, distribution of herbs and lower shrubs towards a greater abundance, closer to the gaps, are common features in tropical forests. The scope of this change depends on the character of the plants close to the gaps, as well as abundance of light. Investigations of gap regeneration point out two main characters of tropical forest species; shade tolerant and shade intolerant. Shade tolerant species are often slow growing and have large seeds, which provide big carbon reserves. Shade sensitive species are determined as fast growing, once a gap is created. They have a shorter lifespan and relatively small seeds that are easily spread (Kellman & Tacaberry, 1997).

Since the results of the t-tests and regressions of the survey did not show any significant changes in neither species richness nor composition, I assume the small variations in the plots to be a result of competition for light and nutrients, rather than human impact. This is shown in the graphs, which indicate a decrease in low shrubs where the amount of herbs are high and vice versa. This is especially clear in trail Campanero (Fig. 14; Fig. 18). In Campanero, the trees are lower, which creates an abundance of light above the trail. Léon, on the other hand, has a very dense canopy roof, which does not allow gaps above the trail. Accordingly, the competition between taller trees and lower plants is greater in Léon than in Campanero.

Tourism in Datanlí has only recently been established, and impacts on tall trees on an altitude above 1,5 meters from ground level are rare. The surveys in both Léon and Campanero (Fig. 4, 8, 12, 16) show no significant change in species richness and number of stems, in the plot close to the trail compared to the control plot. This was expected since no big trees were harvested to provide space for the trail, combined with the rarity of tourism in the area.

In the graphs of taller shrubs, small differences in number of stems are tracked in the plots close to the trail compared to the reference area (Fig. 9, 17). This may be an impact of ecotourism but it is most likely due to harvesting of shrubs in the area close to the trail in 2003, at the time the walking trails were constructed. That theory is strengthened by the fact that the number of stems of lower shrubs is slightly higher close to the trail in Campanero, where the abundance of light provides re-establishment of shrubs (Fig. 18).

Epiphytes and mosses, growing below 1,5 m from ground level, are rare in Datanlí – El Diablo. The scarce light under the canopy creates a growing pattern of epiphytes towards abundance in the canopies and scarcity closer to the ground, where the investigations were made. Mosses mostly grow on branches and rocks and are therefore not common in this

forest, which lacks rocks and branches on the ground. Accordingly, no results of mosses were conducted.

The area is only affected by tourism to a low level and changes in species composition are therefore not clear. Presumably, studies will continue for consecutive years and my study is therefore useful as a base for comparison.

6. 2 Carrying capacity, zonation and park fees

The goal of the development of ecotourism in Datanlí is to keep levels of impacts low, even in the future. The use of effective carrying capacity is useful as a guideline of maximal level of use allowed in the forest. However, carrying capacity is difficult to measure and therefore difficult to control. Further, carrying capacity and LAC-systems may result in too excessive reliance on levels of use allowed. If research is not accurately made and levels therefore are too high, the environment may be overused and destroyed before proactive actions are taken. Besides that, it is difficult to discover the changes in some areas until they are too late to annul. Once levels of LAC and carrying capacity are distinguished, tourism might increase until the levels are reached. The long term effects may create an exceeding of the carrying capacity and therefore destruction of the forest. My conclusions regarding carrying capacity and LAC are consequently that they are useful as guidelines but have to be implemented with caution, since long term effects and effects that are not measurable today have to be taken into consideration.

One tool for control of tourism and generation of monetary income, for conservation and management purposes, is establishment of park fees for visitors. In Datanlí, tourism is underdeveloped and creation of park fees has not been necessary. The main issue today is how to attract tourists to the area, due to its remoteness, rather than keeping tourist away from certain areas. Although, it is important to establish zonation and park fees at an early stage, to prevent destruction of the forest. Today, relatively undeveloped form of zonations exists that can be further refined and used as bases of borders. Within these, charge of park fees can be achieved. Once zones are established, guards and managers have to be employed to secure sensitive zones from excessive tourism.

A park fee for foreign visitors only is a tool to generate monetary inflow for conservation purposes, without compromise the recreational interest among the local communities. Local incomes from harvesting are often lost due to zonation in parks and reserves. By establishment of satisfying communication and cooperation between the managers and the local people, an additional income from the tourism to local communities may cover most of the loss. However, since the area of the study is a reserve today, harvesting is not allowed. Agriculture is nevertheless present inside the reserve today. Whether or not agriculture should be allowed in the future is a question for further research in socio economic aspects and biology.

6.3 Considerations to respect in planning of ecotourism

Regarding ecotourism, lack of definition is the main disadvantage. The common feature to change definition to fit the own purpose and to rise the charge for services provided, has to be avoided. World wide span and interdisciplinary is essential in ecotourism. That often brings difficulties in cooperation among the countries and the different fields. Today, lack of understanding and collaboration between various sciences is a problem, not only in

ecotourism but also in other types of conservation management. Scientists have to be aware of the problem, regarding an excessively narrowness in research, and improve cooperation and sharing of information. A risk concerning globalisation is that most of the power and money is located in the western world. Western values, concerning what is to be preserved and how to do it, is often in a superior position, even in southern countries, where most of the ecotourism is about to be developed.

Although the benefits of ecotourism are unclear, I believe in ecotourism as a replacement of conventional tourism. As stated in the introduction, additional research is essential for further development, to avoid negative effects on the environment. The availability has to be exceeded, to include groups from all income levels, not only the small rich group that can afford to pay entrance fees and higher prices on food and accommodation. Nowadays, I suspect some of the companies that provide ecotourism to take advantage of the label and thus charge higher costs than necessary. Control of the establishment of ecotourism in an area and clear definitions and legislations regarding ecotourism is important to avoid disreputable companies to take advantage of ecotourism, without fulfilling the sustainability that is the mainstay of ecotourism.

6.4 Recommendations

As far as I concern, the PhD study of Matilde Somarriba Chang and the collaboration with MARENA and local communities in the area of Datanlí – El Diablo is a good example on research, which is essential before establishing ecotourism in an area. However, further research of tourism's impact on the vegetation is important, now and for consecutive years.

The present goal is to attract tourists to the reserve. Today, the roads are not in satisfying condition, and no bus traffic is present in the area between Jinotega and Datanlí. Tourists will therefore experience difficulties to get to the area and thus, some of its appeal might be lost. Sites of ecotourism are often remote, and in this case, also in high altitude. An important problem to solve, regarding transportation, is reduction of the big emissions of CO_2, a well known greenhouse gas, which will increase when tourism increases. To achieve an environmental friendlier tourism, focus on not only the site, but also emissions to air and water from departure to arrival, is important. An alternative fuel, such as biogas could be one solution. Additionally research and construction of factories is although needed in the development of biogas. Such activities are expensive. Therefore, biogas development is difficult to achieve in a country with a poor economic situation. Despite all the difficulties, these problems can not be neglected and have to be encountered when planning for ecotourism. One inception of solving the transportation problem in Datanlí is provision of public busses twice or three times a day. That would decrease the need of cars as means of transport, and benefit the environment in the area.

Another issue is the lingual differences between the managers of cabins and trails and the tourists. Information and education, which is one of the mainstays of ecotourism, will thus fail. If ecotourism in Datanlí is to be achieved and developed, employment of English speaking guides is necessary.

6.5 Future of ecotourism

An obstacle regarding ecotourism is that it may grow too big to keep densities of people low in sensitive habitats. Probably, in eagerness to maximize profits, the tourism industry will try to increase the density of tourists until it exceeds the carrying capacity of the environment. If that happens, the base of ecotourism will be ruined. Another concern is that the word ecotourism is misleading. Taking into consideration transportation and construction of hotels and infrastructure, ecotourism is not environmentally friendly. It is a better option than conventional tourism, but people have to be aware of the negative effects of all tourism.

In tourism, an abundance of negative secondary effects, such as gas emissions and over population of sensitive areas is a common feature. CO_2 from the airplanes contributes to the greenhouse effect and crowdedness and ignorant behavior from the tourists cause degradation of forests and coral reefs. Despite this, I am almost certain that the industry will continue to increase in the future. An increasing travel culture is encouraged by lower prices on air travel and a travel culture, partly governed by media and commercials.

Media affects us more now than ever and often influences where, and how, people are traveling. The affection from media creates artificial preferences in the choice of area and experiences expected from a journey. This impact may be beneficial in development of a sustainable tourism; to spread information and raise people's interest in nature. A raising interest in sustainability might change consumption patterns towards sustainable produced products. When tourists are influenced to concern the well being of the environment and the effects of their actions, the mistakes caused by conventional tourism can be avoided.

The most significant goal in creation of ecotourism is the involvement of local communities. Today, the local culture is only of importance for governments and companies when it creates an inflow of money. The native citizens themselves are often neglected and sometimes forced to move, to provide space for tourists. Now, 75 – 90 percent of the money from tourism disappears from the country in form of profits to tourist companies. To stop this development and improve the tourism, one has to cooperate with the local people that know the most about the local environment. If they experience participation and monetary inflow, they may be willing to keep the nature in its present state. However, many difficulties occur in cooperation with indigenous people. The most complicated issue is that they, despite to what many organizations seem to think, are not a homogenic group. In a community, different preferences and goals as well as lack of organization often occur. Agreements in between the groups are therefore difficult to establish. Often, linguistic and religious differences between tourist companies and local communities add to the complicities in establishment of a dialog, where everyone has the possibility to deliver their standpoint. Local companies that have time for dialogs and research have probably the best chances in achieving success.

Unfortunately, it is almost impossible to force companies to share their profits and provide positive experiences for local people. The ideal ecotourism company is probably a non-profit corporation based on voluntary work. When an organization is based on voluntary work, it is important to secure a satisfying knowledge among the staff, as well as establishment of long lasting and well managed projects. As stated earlier in the discussion, an interdisciplinary standpoint is a key to success. Therefore, I encourage cooperation between biologists, anthropologists and many other sciences. Only when cooperation, discussions and debates about the impacts of tourism is created, a major change of e.g. fuel of air traffic is possible.

CHAPTER 7

Conclusions

The results of the inventories in both areas did not show any significant changes in neither species richness, nor composition. Variation of species in the plots is probably a result of competition for light and nutrients, rather than human impacts. This is shown in the surveys, where a decrease in herbs appears where the amount of shrubs is high and vice versa.
Tourism in Datanlí is recently established, and impacts on tall trees on an altitude above 1,5 meters from ground level are rare. For shrubs taller than 1,5 m, small changes in number of stems can be spotted in the plots of investigation compared to the references. However, the changes are not significant and probably a result of disturbances in construction of the trails rather than ecotourism

Epiphytes and mosses, growing below 1,5 m from ground level, are scarce. The low level of light under the canopy creates a growing pattern of epiphytes towards abundance in the canopies and scarcity in lower levels. Therefore, the inventories of epiphytes did not show any satisfying results. Mosses thrive in rocks on the forest floor. The sparse amount of rocks in combination with competition from herbs and shrubs, creates an unfavourable habitat for mosses in this forest. Accordingly, the inventories showed no results of mosses.

At the time of the survey, ecotourism in Datanlí has not yet been developed. The purpose is consequently to use the results as a base for further investigation, rather than discovering changes that occur today.

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APPENDIX 1

Number of species and diversity indices for the plots in trail Léon

Table 1: *Number of species and diversity indices in plots situated 0-10 m from trail Léon.*

Type	**B1 $_{big}$**	**C1 $_{big}$**	**D1 $_{big}$**	**E1 $_{big}$**	**F1 $_{big}$**	**G1 $_{big}$**
Trees	3	5	9	3	8	5
Shrubs	0	0	1	0	0	0
$D_{Simpsons}$ trees	0,00018	0,00033	0,00026	0,00003	0,00028	0,038
$D_{Simpsons}$shrubs	0	0	0,00012	0	0	0

Type	**H1 $_{big}$**	**I1 $_{big}$**	**J1 $_{big}$**	**K1 $_{big}$**	**Mean value**
Trees	7	8	7	8	6
Shrubs	0	3	4	2	1
$D_{Simpsons}$ trees	0,00013	0,00010	0,000090	0,00072	0,0040
$D_{Simpsons}$shrubs	0	0,00035	0,027	0,00024	0,0027

Table 2: *Number of species and diversity indices in plots situated 10-20 m from trail Léon.*

Type	**B2 $_{big}$**	**C2 $_{big}$**	**D2 $_{big}$**	**E2 $_{big}$**	**F2 $_{big}$**	**G2 $_{big}$**
Trees	4	6	No info	5	7	6
Shrubs	1	0	No info	1	1	3
$D_{Simpsons}$ trees	0,016	0,00022	No info	0,000064	0,00027	0,00082
$D_{Simpsons}$shrubs	0,00012	0	No info	0,04265	0,00012	0,02682

Type	**H2 $_{big}$**	**I2 $_{big}$**	**J2 $_{big}$**	**K2 $_{big}$**	**Mean value**
Trees	6	4	4	9	6
Shrubs	3	1	4	1	2
$D_{Simpsons}$ trees	0,00093	0,00017	0,00055	0,0019	0,0023
$D_{Simpsons}$shrubs	0,00035	0,00047	0,0018	0,0082	0,0089

Table 3: *Number of species and diversity indices in sub plots situated 0-2 m from trail Léon.*

Type	B1	C1	D1	E1	F1	G1
Herbs	0	1	2	1	4	1
Mosses	0	1	0	0	0	0
Epiphytes	0	0	0	0	0	0
Shrubs	4	2	2	3	3	1
$D_{Simpsons}$ herbs	0	0,000040	0,00059	0,000040	0,0027	0,0000090
$D_{Simpsons}$ epiphytes	0	0	0	0	0	0
$D_{Simpsons}$ shrubs	0,0010	0,00011	0,0021	0,000032	0,000032	0,000011

Type	H1	I1	J1	K1	Mean value
Herbs	2	2	3	2	2
Mosses	0	0	0	0	0
Epiphytes	1	0	1	1	0
Shrubs	1	1	0	0	2
$D_{Simpsons}$ herbs	0,000011	0,000059	0,0083	0,000045	0,0012
$D_{Simpsons}$ epiphytes	0,00020	0	0,013	0,0033	0,0017
$D_{Simpsons}$ shrubs	0,00052	0,00017	0	0	0,00040

Table 4: *Number of species and diversity indices in sub plots situated 2-4 m from trail Léon.*

Type	B2	C2	D2	E2	F2	G2
Herbs	2	1	2	1	2	2
Mosses	0	1	0	0	0	1
Epiphytes	0	0	0	0	0	0
Shrubs	3	1	1	2	5	1
$D_{Simpsons}$ herbs	0,000011	0,0000090	0,00014	0,000020	0,000029	0,000023
$D_{Simpsons}$ epiphytes	0	0	0	0	0	0
$D_{Simpsons}$ shrubs	0,00028	0,000011	0,00027	0,000021	0,00033	0,000011

Type	H2	I2	J2	K2	Mean value
Herbs	3	1	3	2	2
Mosses	0	0	0	0	0
Epiphytes	0	0	1	1	0
Shrubs	1	2	0	1	2
$D_{Simpsons}$ herbs	0,00057	0,00033	0,0044	0,0000050	0,00056
$D_{Simpsons}$ epiphytes	0	0	0,0051	0,00020	0,00053
$D_{Simpsons}$ shrubs	0,0011	0,00027	0	0,000011	0,00023

Table 5: *Number of species and diversity indices in sub plots situated 4-6 m from trail Léon.*

Type	B3	C3	D3	E3	F3	G3
Herbs	0	0	2	2	4	0
Mosses	0	1	0	0	0	0
Epiphytes	0	0	0	0	0	1
Shrubs	4	1	1	3	3	1
$D_{Simpsons}$ herbs	0	0	0,0000050	0,000029	0,00025	0
$D_{Simpsons}$ epiphytes	0	0	0	0	0	0,00020
$D_{Simpsons}$ shrubs	0,00049	0,00017	0,00052	0,000032	0,000032	0,000095

Type	H3	I3	J3	K3	Mean value
Herbs	3	4	1	2	2
Mosses	0	0	0	0	0
Epiphytes	0	0	3	1	0
Shrubs	1	1	0	0	2
$D_{Simpsons}$ herbs	0,00031	0,00035	0,0028	0,000084	0,00038
$D_{Simpsons}$ epiphytes	0	0	0,00061	0,00020	0,00010
$D_{Simpsons}$ shrubs	0,000095	0,00017	0	0	0,00016

Table 6: *Number of species and diversity indices in sub plots situated 6-8 m from trail Léon.*

Type	**B4**	**C4**	**D4**	**E4**	**F4**	**G4**
Herbs	0	0	1	0	3	1
Mosses	0	1	0	0	0	0
Epiphytes	0	0	0	0	0	0
Shrubs	3	1	2	3	5	5
$D_{Simpsons}$ herbs	0	0	0,00051	0	0,00023	0,0000090
$D_{Simpsons}$ epiphytes	0	0	0	0	0	0
$D_{Simpsons}$ shrubs	0,0017	0,00017	0,0046	0,00040	0,000053	0,00052

Type	**H4**	**I4**	**J4**	**K4**	**Mean value**
Herbs	2	2	3	3	2
Mosses	0	1	0	0	0
Epiphytes	0	1	1	1	0
Shrubs	0	0	0	0	2
$D_{Simpsons}$ herbs	0,000057	0,00038	0,0020	0,000066	0,00033
$D_{Simpsons}$ epiphytes	0	0,0051	0,0018	0,00020	0,00071
$D_{Simpsons}$ shrubs	0	0	0	0	0,00075

Table 7: *Number of species and diversity indices in sub plots situated 8-10 m from trail Léon.*

Type	B5	C5	D5	E5	F5	G5
Herbs	0	0	3	1	2	1
Mosses	0	0	0	0	0	0
Epiphytes	0	1	0	0	0	0
Shrubs	5	2	1	5	4	3
$D_{Simpsons}$ herbs	0	0	0,0035	0,000036	0,0028	0,000057
$D_{Simpsons}$ epiphytes	0	0,00020	0	0	0	0
$D_{Simpsons}$ shrubs	0,0011	0,00034	0,0013	0,0044	0,000074	0,00020

Type	H5	I5	J5	K5	Mean value
Herbs	3	1	2	2	2
Mosses	0	1	0	0	0
Epiphytes	1	1	3	2	0
Shrubs	1	1	0	0	2
$D_{Simpsons}$ herbs	0,00024	0,00091	0,00094	0,000029	0,00085
$D_{Simpsons}$ epiphytes	0,00020	0,11	0,0067	0,0010	0,012
$D_{Simpsons}$ shrubs	0,0011	0,000011	0	0	0,00086

APPENDIX 2

Number of stems for the species in trail Léon

Table 1: *Number of stems in plots situated 0-10 m from trail Léon, Datanlí -El Diablo.*

Type	B1 $_{big}$	C1 $_{big}$	D1 $_{big}$	E1 $_{big}$	F1 $_{big}$	G1 $_{big}$
Trees	6	10	12	3	12	59
Shrubs	0	0	1	0	0	0

Type	H1 $_{big}$	I1 $_{big}$	J1 $_{big}$	K1 $_{big}$	Mean value
Trees	8	8	7	14	14
Shrubs	0	3	25	2	3

Table 2: *Number of stems in plots situated 10-20 m from trail Léon, Datanlí -El Diablo.*

Type	B2 $_{big}$	C2 $_{big}$	D2 $_{big}$	E2 $_{big}$	F2 $_{big}$	G2 $_{big}$
Trees	40	9	No info	5	11	16
Shrubs	1	0	No info	19	1	17

Type	H2 $_{big}$	I2 $_{big}$	J2 $_{big}$	K2 $_{big}$	Mean value
Trees	14	7	11	27	16
Shrubs	3	2	7	11	7

Table 3: *Number of stems in sub plots situated 0-2 m from trail Léon, Datanlí -El Diablo.*

Type	B1	C1	D1	E1	F1	G1
Herbs	0	4	21	4	53	2
Mosses	0	3,1 %	0	0	0	0
Epiphytes	0	0	0	0	0	0
Shrubs	17	4	18	3	3	1

Type	H1	I1	J1	K1	Mean value
Herbs	3	6	70	6	17
Mosses	0	0	0	0	0,3 %
Epiphytes	1	0	8	4	1
Shrubs	7	4	0	0	6

Table 4: *Number of stems in sub plots situated 2-4 m from trail Léon, Datanlí -El Diablo.*

Type	B2	C2	D2	E2	F2	G2
Herbs	3	2	11	3	5	4
Mosses	0	37,5 %	0	0	0	9,4 %
Epiphytes	0	0	0	0	0	0
Shrubs	8	1	5	2	11	1

Type	H2	I2	J2	K2	Mean value
Herbs	22	12	56	2	12
Mosses	0	0	0	0	4,7 %
Epiphytes	0	0	5	1	1
Shrubs	10	7	0	1	5

Table 5: *Number of stems in sub plots situated 4-6 m from trail Léon, Datanlí -El Diablo.*

Type	B3	C3	D3	E3	F3	G3
Herbs	0	0	2	5	20	0
Mosses	0	37,5 %	0	0	0	0
Epiphytes	0	0	0	0	0	1
Shrubs	12	4	7	3	3	3

Type	H3	I3	J3	K3	Mean value
Herbs	16	24	35	7	11
Mosses	0	0	0	0	3,8 %
Epiphytes	0	0	3	1	1
Shrubs	3	4	0	0	1

Table 6: *Number of stems in sub plots situated 6-8 m from trail Léon, Datanlí -El Diablo.*

Type	B4	C4	D4	E4	F4	G4
Herbs	0	0	15	0	12	2
Mosses	0	75,0 %	0	0	0	0
Epiphytes	0	0	0	0	0	0
Shrubs	17	4	26	8	5	15

Type	H4	I4	J4	K4	Mean value
Herbs	7	17	32	9	9
Mosses	0	75 %	0	0	15 %
Epiphytes	0	5	3	1	1
Shrubs	0	0	0	0	8

Table 7: *Number of stems in sub plots situated 8-10 m from trail Léon, Datanlí -El Diablo.*

Type	B5	C5	D5	E5	F5	G5
Herbs	0	0	65	4	36	5
Mosses	0	0	0	0	0	0
Epiphytes	0	1	0	0	0	0
Shrubs	21	8	11	27	5	7

Type	H5	I5	J5	K5	Mean value
Herbs	13	20	24	5	17
Mosses	0	9,4 %	0	0	0,9 %
Epiphytes	1	23	9	3	4
Shrubs	10	1	0	0	9

APPENDIX 3

Number of species and diversity indices for trail Campanero.

Table 1: *Number of species and diversity indices in plots 0-10 m from trail Campanero.*

Type	**A1$_{big}$**	**C*1 $_{big}$**	**B1 $_{big}$**	**B*1 $_{big}$**	**C1 $_{big}$**	**A*1 $_{big}$**	**Mean value**
Trees	6	6	3	7	4	8	6
Shrubs	4	0	3	0	5	0	2
$D_{Simpsons}$ trees	0,00036	0,0013	0,00036	0,00120	0,00066	0,0052	0,0016
$D_{Simpsons}$ shrubs	0,0011	0	0,00056	0	0,57	0	0,094

Table 2: *Number of species and diversity indices in plots 10-20 m from trail Campanero.*

Type	**A2 $_{big}$**	**C*2 $_{big}$**	**B2 $_{big}$**	**B*2 $_{big}$**	**C2 $_{big}$**	**A*2 $_{big}$**	**Mean value**
Trees	7	4	6	7	8	7	7
Shrubs	3	3	4	1	3	1	3
$D_{Simpsons}$ trees	0,00051	0,0016	0,0039	0,0052	0,00051	0,0020	0,0023
$D_{Simpsons}$ shrubs	0,016	0,0053	0,029	0,00028	0,00083	0,0025	0,0091

Table 3: *Number of species and diversity indices in sub plots 0-2 m from trail Campanero.*

Type	**A1**	**C*1**	**B1**	**B*1**	**C1**	**A*1**	**Mean value**
Herbs	3	1	2	0	3	0	2
Mosses	0	0	0	0	0	0	0
Epiphytes	0	0	0	0	0	0	0
Shrubs	0	9	1	7	0	9	4
$D_{Simpsons}$ herbs	0,00027	0,00059	0,0096	0	0,00041	0	0,0018
$D_{Simpsons}$ epiphytes	0	0	0	0	0	0	0
$D_{Simpsons}$ shrubs	0	0,0013	0,000030	0,0043	0	0,0015	0,0012

Table 4: *Number of species and diversity indices in sub plots 2-4 m from trail Campanero.*

Type	A2	C*2	B2	B*2	C2	A*2	Mean value
Herbs	2	1	2	0	1	2	1
Mosses	0	0	1	0	0	0	0
Epiphytes	2	0	1	0	1	0	1
Shrubs	1	6	0	7	0	6	3
$D_{Simpsons}$ herbs	0,00091	0,000050	0,021	0	0,000020	0,00010	0,0037
$D_{Simpsons}$ epiphytes	0,0069	0	0,00070	0	0,00070	0	0,0014
$D_{Simpsons}$ shrubs	0,00046	0,0033	0	0,00075	0	0,00081	0,00088

Table 5: *Number of species and diversity indices in sub plots 4-6 m from trail Campanero.*

Type	A3	C*3	B3	B*3	C3	A*3	Mean value
Herbs	1	1	2	0	2	1	1
Mosses	0	0	0	0	0	0	0
Epiphytes	1	0	1	1	1	0	1
Shrubs	1	6	0	6	0	4	3
$D_{Simpsons}$ herbs	0,0095	0,00021	0,015	0	0,00024	0,000090	0,0042
$D_{Simpsons}$ epiphytes	0,017	0	0,00070	0,00070	0,025	0	0,0073
$D_{Simpsons}$ shrubs	0,00046	0,00017	0	0,00043	0	0,00035	0,00024

Table 6: *Number of species and diversity indices in sub plots 4-8 m from trail Campanero.*

Type	A4	C*4	B4	B*4	C4	A*4	Mean value
Herbs	3	1	3	0	3	1	2
Mosses	0	0	0	0	0	0	0
Epiphytes	0	0	1	0	1	0	0
Shrubs	0	3	1	5	0	3	2
$D_{Simpsons}$ herbs	0,00091	0,000050	0,0028	0	0,00015	0,000010	0,00065
$D_{Simpsons}$ epiphytes	0	0	0,017	0	0,0062	0	0,0039
$D_{Simpsons}$ shrubs	0	0,00026	0,000030	0,0040	0	0,00017	0,00075

Table 7: *Number of species and diversity indices in sub plots 8-10 m from trail Campanero.*

Type	**A5**	**C*5**	**B5**	**B*5**	**C5**	**A*5**	**Mean value**
Herbs	2	1	2	0	3	1	2
Mosses	0	0	0	0	0	0	0
Epiphytes	1	0	1	0	1	0	1
Shrubs	1	6	2	5	0	2	3
$\mathbf{D_{Simpsons}}$ **herbs**	0,00019	0,00002	0,0057	0	0,00036	0,000090	0,0011
$\mathbf{D_{Simpsons}}$ **epiphytes**	0,0062	0	0,0028	0	0,025	0	0,0057
$\mathbf{D_{Simpsons}}$ **shrubs**	0,000030	0,00026	0,00006	0,0015	0	0,00049	0,00039

APPENDIX 4

Number of stems for the species in trail Campanero

Table 1: *Number of stems in plots situated 0-10 m from trail Campanero.*

Plot	A1 $_{big}$	C*1 $_{big}$	B1 $_{big}$	B*1 $_{big}$	C1 $_{big}$	A*1 $_{big}$	Mean value
No of trees	8	12	5	18	8	32	14
No of shrubs	4	0	3	0	7	0	2

Table 2: *Number of stems in plots situated 10-20 m from trail Campanero.*

Plot	A2$_{big}$	C*2 $_{big}$	B2 $_{big}$	B*2 $_{big}$	C2 $_{big}$	A*2 $_{big}$	Mean value
No of trees	9	14	20	26	11	19	17
No of shrubs	14	7	18	1	3	3	8

Table 3: *Number of stems in sub plots situated 0-2 m from trail Campanero.*

Plot	A1	C*1	B1	B*1	C1	A*1	Mean value
No of herbs	11	10	45	0	14	0	13
No of mosses	0	0	0	0	0	0	0
No of epiphytes	0	0	0	0	0	0	0
No of shrubs	0	17	1	25	0	16	10

Table 4: *Number of stems in sub plots situated 2-4 m from trail Campanero.*

Plot	A2	C*2	B2	B*2	C2	A*2	Mean value
No of herbs	15	3	64	0	2	5	15
No of mosses	0	0	9,4 %	0	0	0	1,6 %
No of epiphytes	4	0	1	0	1	0	1
No of shrubs	4	17	0	12	0	12	8

Table 5: *Number of species in sub plots situated 4-6 m from trail Campanero.*

Plot	A3	C*3	B3	B*3	C3	A*3	Mean value
No of herbs	40	6	54	0	9	4	19
No of mosses	0	0	0	0	0	0	0
No of epiphytes	5	0	1	1	6	0	1
No of shrubs	4	6	0	9	0	6	4

Table 6: *Number of stems in sub plots situated 6-8 m from trail Campanero.*

Plot	A4	C*4	B4	B*4	C4	A*4	Mean value
No of herbs	21	3	31	0	8	1	11
No of mosses	0	0	0	0	0	0	0
No of epiphytes	0	0	5	0	3	0	1
No of shrubs	0	5	1	19	0	4	5

Table 7: *Number of stems in sub plots situated 8-10 m from trail Campanero.*

Plot	A5	C*5	B5	B*5	C5	A*5	Mean value
No of herbs	8	2	38	0	13	4	11
No of mosses	0	0	0	0	0	0	0
No of epiphytes	3	0	2	0	6	0	2
No of shrubs	1	7	2	13	0	5	5

APPENDIX 5

Results from the t-test

Table 1: *T-test for species of trees in Léon.*

Plot	t-test value	n-1	Critical value 0,95
0-10 m	0,7498	9	1,833
10 – 20 m	0,7498	8	1,860

Table 2: *T-test for species of shrubs in Léon.*

Plot	t-test value	n-1	Critical value 0,95
0-10 m	1,259	9	1,833
10 – 20 m	1,259	8	1,860

Table 3: *T-test for stems of trees in Léon.*

Plot	t-test value	n-1	Critical value 0,95
0-10 m	0,2709	9	1,833
10 – 20 m	0,2709	8	1,860

Table 4: *T-test for stems of shrubs in Léon.*

Plot	t-test value	n-1	Critical value 0,95
0-10 m	1,189	9	1,833
10 – 20 m	1,189	8	1,860

Table 5: *T-test for species of trees in Campanero.*

Plot	t-test value	n-1	Critical value 0,95
0-10 m	1,147	5	2,015
10 – 20 m	1,147	5	2,015

Table 6: *T-test for species of shrubs in Campanero.*

Plot	t-test value	n-1	Critical value 0,95
0-10 m	0,6470	5	2,015
10 – 20 m	0,6470	5	2,015

Table 7: *T-test for stems of trees in Campanero.*

Plot	t-test value	n-1	Critical value 0,95
0-10 m	0,6685	5	2,015
10 – 20 m	0,6685	5	2,015

Table 8: *T-test for stems of shrubs in Léon.*

Plot	t-test value	n-1	Critical value 0,95
0-10 m	1,983	5	2,015
10 – 20 m	1,983	5	2,015

APPENDIX 6

Results from the regression

Table 1: *Values from regression of stems in Léon.*

Type	r^2	r	a	b	P
Herbs	0,0170	0,1304	13,95	-0,15	0,834
Shrubs	0,2088	0,4569	3,55	0,45	0,439

Table 2: *Values from regression of species in Campanero.*

Type	r^2	r	a	b	P
Herbs	0,0833	0,2886	1,35	0,05	0,638
Shrubs	0,4500	0,6708	3,75	-0,15	0,215
Epiphytes	0,0833	0,2886	0,35	0,05	0,638

Table 3: *Values from regression of stems in Campanero.*

Type	r^2	r	a	b	P
Herbs	0,1429	0,3780	15,8	-0,4	0,530
Shrubs	0,6706	0,8189	9,65	-0,65	0,090
Epiphytes	0,5714	0,7559	0,2	0,2	0,139

APPENDIX 7

General Field protocol for Datanlí – El Diablo, Study site Léon

Date	2006-10-31
Description of the study area	In the beginning of the trail, coffee and banana plantings in agroforestry systems are present. The trail ends in pasture land and open fields. Upwards, the land slopes steeply (around 30 %). The forest is denser in higher altitudes. Humidity is high with abundance of rain. On high altitude, clouds are constantly present. The trail is small (average width of about 50 cm) and muddy. Wooden steps have been laid out at the steepest parts of the trail to avoid slipping. No trees have been cut to provide space for the trail. A stair rail has been built on almost all parts of the trail. Lack of wildlife during the days. Crabs, insects and a few birds were spotted. No tourism in the area at the time of the study.

Transect no A (left side)

Time	12.20

Description of the transect	Coffee and banana agroforestry plantings. This transect will not be compared with the other transects since the area is highly impacted by other activities than ecotourism. It will be impossible to distinguish effects of tourism from effects of agriculture. Steep upslope. The trail is about 30 cm wide and not heavily trampled.
Slope from the trail to the end of the transect	30 %
GPS	16622214 E 1454575 N
Altitude	1325 m above sea level

Transect no B (right side)

Time	14.50

Description of the transect	Dense forest. Abundance of trees. Lack of groundcover. Steep upward slope. Clay soil with wooden steps to avoid slipping. Trail about 50 cm wide. The trail bends around the area of the plots and affects the big plots from two sides (front side and left side). Difficulties to entrance the area.
Slope from the trail to the end of the transect	20 %
GPS	16622232 E 1454470 N
Altitude	1348 m above sea level

Date	2006-11-01

Transect no C (left side)

Time	10.00

Description of the transect	Dense forest. Abundance of shrubs and lower trees. Few tall trees, few herbs, Abundance of epiphytes and mosses. No stranglers. Clay soil with relatively abundant litter layer. The trail bends around the area of the plots, which causes biases, in forms of impacts from all sides of the big plots. The impacts are probably not significant since the tall trees are less affected by the tourism.
Slope from the trail to the end of the transect	30 %
GPS	16622343 E 1454401 N
Altitude	1361 m above sea level

Transect no D (right side)

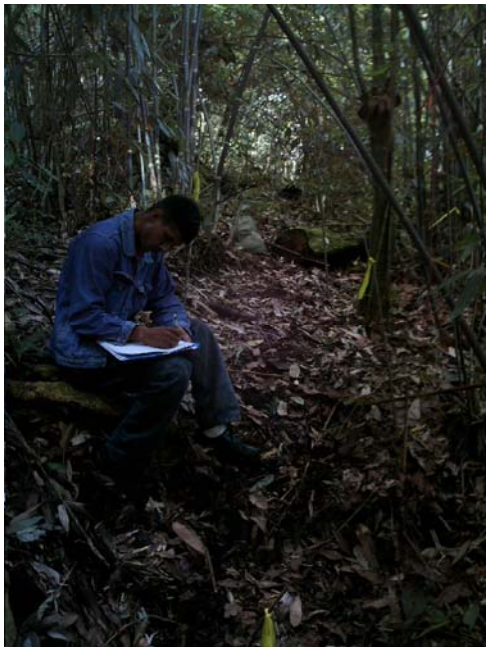
Time	11.15

Description of the transect	Transect close to a large deforested area. Abundance of light. Few tall trees. Huge human impacts here. Human impacts from other sources than tourism are big. It is only possible to achieve one big plot here because of the small area between the trail and the deforested area. All plots are impacted from all sides. Relatively small slope.
Slope from the trail to the end of the transect	8 %
GPS	16622425 E 1454518 N
Altitude	1325 m above sea level

Transect no E (left side)

Time	12.15

Description of the transect	Dense forest. Lack of big trees, abundance of shrubs. Dense roof from small trees, lack of light. The trail bends, which might cause impacts from more than one side of the plots.
Slope from the trail to the end of the transect	20 %
GPS	16622624 E 1454536 N
Altitude	1389 m above sea level



Transect no F (right side)

Time	13.30

Description of the transect	Dense forest, relatively much ground flora. Dense canopy roof, abundance of litter on the floor. The trail is bending around the transect and causes biases.
Slope from the trail to the end of the transect	6 %
GPS	16622719 E 1454666 N
Altitude	1397 m above sea level

Transect no G (left side)

Time	15.00

Description of the transect	Lack of groundcover. Mainly shrubs and skinny trees. Dense canopy roof. Down slope along the transect.
Slope from the trail to the end of the transect	35%
GPS	16622877 E 1454643 N
Altitude	1354 m above sea level

Transect no H (right side)

Time	15.00

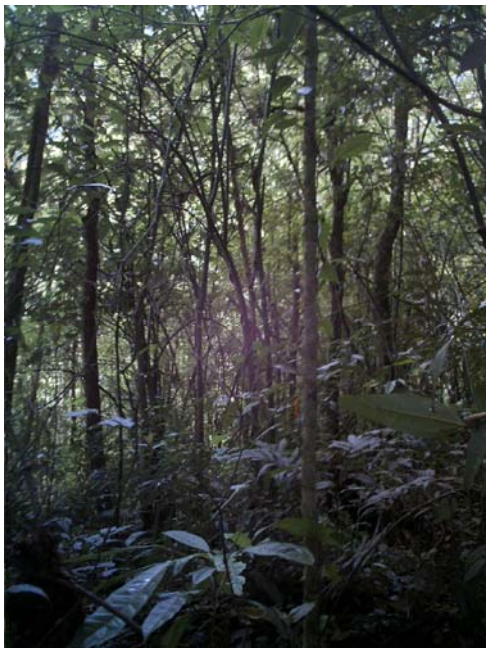
Description of the transect	Less dense forest. Much light and younger trees. Abundance of shrubs and groundcover. Sloping down/left. An open, impacted area surrounds the plots.
Slope from the trail to the end of the transect	25 %
GPS	16622983 E 1454578 N
Altitude	1329 m above sea level

Date	2006-11-02

Transect no I (left side)

Time	8.40

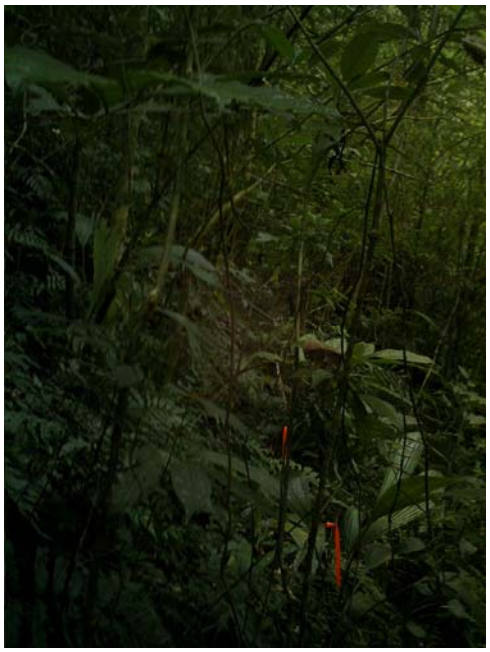
Description of the transect	Open forest and abundance of ground flora. Relatively many big trees and shrubs. Lack of mosses. Trail on both sides of the big plots, probably limited impacts in the subplots. Sub trails inside the plots affect both plots and sub plots. One part of the trail bends to appear inside one big plot and thus causes bias. Impossible to create plots that do not have any part of the trail inside. Sloping down/right.
Slope from the trail to the end of the transect	25 %
GPS	16623176 E 1454606 N
Altitude	1307 m above sea level



Transect no J (right side)

Time	9.41

Description of the transect	Next to a small river. Open forest, abundance of light. Abundance of ground vegetation. Difficulties to achieve equal plots because of sloping ground and abundance of ground vegetation. Steep right slope.
Slope from the trail to the end of the transect	0 % along the transect
GPS	16623134 E 1454643 N
Altitude	1291 m



Transect no K (left side)

Time	12.00

Description of the transect	Less sloping ground. Little left slope at the end of the transect. Ups and downs slopes within the plots. Abundance of shrubs and litter on the floor. Open space about 100 m from the plots
Slope from the trail to the end of the transect	5 %
GPS	No connection
Altitude	No connection

APPENDIX 8

General Field protocol for Datanlí – El Diablo, Study site Campanero

Description of the study area	The trail starts and ends in pasture land and open areas. Upwards, the land is sloping (around 30 %). The forest is equally dense along the trail. Humidity is high, abundance of rain. The trail is small (average of about 30 cm wide) and muddy at some parts. Some parts of the trail are almost impossible to distinguish, since the impacts of tourism are small. Wooden steps have been laid out at the steepest parts of the trail to avoid slipping. No trees have been cut to provide space for the trail. A stair rail has been built along parts of the trail. No abundance of wildlife during the days. Crabs, insects and a few birds were spotted. No tourism in the area at the time of the study.

Transect no A (right side)

Date	2006-11-02

Time	14.50

Description of the transect	Open forest, abundance of light. Many tall trees and shrubs. Downward slope.
Slope from the trail to the end of the transect	30 %
GPS	16622951 E 1454853 N
Altitude	1286 m above sea level

Transect no C* (right side)

Date	2006-11-16

Time	16.30

Description of the transect	Open forest. Many shrubs, smaller trees and ground vegetation. Much light. A few big trees. Steep down slope. In the forward/left side of the transect is an open area, which might affect the plots in the sense of light.
Slope from the trail to the end of the transect	30 %
GPS	16622854 E 1454829 N
Altitude	1336 m above sea level

Transect no B (left side)

Date	2006-11-02

Time	15.12

Description of the transect	Open forest, abundance of light. Many tall trees and shrubs. Downward slope.
Slope from the trail to the end of the transect	27 %
GPS	16622778 E 1454915 N
Altitude	1337 m above sea level

Transect no B* (left side)

Date	2006-11-16

Time	15.32

Description of the transect	Shrubby forest with abundance of ground vegetation. Many tiny trees. Much light. Abundance of litter on the ground. A few wide trees. Up slope close the trail, down slope further out.
Slope from the trail to the end of the transect	8 %
GPS	16622883 E 1454893 N
Altitude	1323 m above sea level

Transect no C (right side)

Date	2006-11-02

Time	16.17

Description of the transect	Outer part of the forest. Some parts of the plots are situated in open forest. The big plots end in a coffee plantation, which causes bias. The subplots might also be affected in terms of abundance of light. In the inventories of the 5th subplot, lack of light, which might cause biases in the amount of species found.
Slope from the trail to the end of the transect	25 %
GPS	No connection
Altitude	No connection

Transect no A* (right side)

Date	2006-11-16

Time	12.50

Description of the transect	Open shrubby forest and abundance of ground vegetation. Many tiny trees but no wide trees. Abundance of litter on the ground. Looks like young forest. Quite much light. Ends in an open space, which might cause biases. Steep down slope.
Slope from the trail to the end of the transect	30 %
GPS	16622687 E 1454925 N
Altitude	1181 m above sea level

APPENDIX 9

Field protocol for the transects in Datanlí – El Diablo

Sendero: Léon Transecto A

Parcela 1: Arbusto, arbols mayores y iguales a 1,5 m, 0-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Pufa	No identificado	1	Arbusto	Maleza

Parcela 2: Arbusto, arbols mayores y iguales a 1,5 m, 10-20 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Chichicaste	*Urera baccifera*	1	Arbuso	Maleza
Guaba	*Phytolacca ssp.* *PHYTOLACCACEAE*	1	Arbol	Leña
Flor de gorrion	No identificado	4	Arbusto	Ornamental

Sub parcela 1: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 0-2 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Maraya	*Geonoma ssp.* *ARECACEAE*	2	Hierba	Maleza
Rodia de jolote	No identificado	3	Hierba	Maleza
Chucho	*Peperomia ssp.* *PIPERACEAS*	1	Hierba	Maleza
Lengua de vaca	*Lagascea helianthifolia* *ASTRACEAE*	1	Hierba	Maleza
Batata	*Convolvulus batatas* *CONVOLVULACEAE*	1	Hierba	Maleza
Carrizon	*Lasacis ruscifolia var. veltunia* *POACEAE*	1	Hierba	Maleza
Sombrerillo	*Hydrocotyle ssp.* *APIACEAE*	1	Hierba	Maleza
Coyolillo	*Bactris blalnoides* *ARARCEAE*	1	Hierba	Maleza
Pufa	No identificado	1	Arbusto	Maleza
Musgo	*Bazzania schlimania* *LEPIDOZIACEAE*	9.4 %	Musgo	Adornar

Sub parcela 2: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 2-4 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Batata	*Convolvulus batatas* *CONVOLVULACEAE*	2	Hierba	Maleza
Musgo	*Bazzania schlimania* *LEPIDOZIACEAE*	3.1 %	Musgo	Adornar
Grama de piedra	Grama = *Gynerium*	1	Hierba	Ecologico

	spp. *POACEAE*			
Mal humor	No identificado	7	Hierba	No tiene
Carrizon	*Lasacis ruscifolia var. veltunia* *POACEAE*	1	Hierba	Maleza
Chucho	*Peperomia ssp.* *PIPERACEAS*	1	Hierba	Maleza

Sub parcela 3: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 4-6 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Musgo	*Bazzania schlimania* *LEPIDOZIACEAE*	35 %	Musgo	Ornamental
Hierba de conejo	*Epithelanta micromeris* *CACTACEAE*	10	Hierba	Ecologico
Chucho	*Peperomia ssp.* *PIPERACEAS*	3	Hierba	Maleza
Rodia de jolote	No identificado	1	Hierba	Maleza
Flor amarilla	*Baltimora recta L.* *ASTERACEAE*	2	Hierba	No tiene
Batata	*Convolvulus batatas L.* *CONVOLVULACEAE*	2	Hierba	Maleza
Pufa	No identificado	1	Arbusto	Maleza
Uetecho	No identificado	2	Hierba	Medicinal
Huele de noche	*Cestrum aurantiacum* *SOLANACEAE*	2	Hierba	Ecologico
Hierba tierra	No identificado	10	Hierba	Ecologico

Sub parcela 4: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 6-8 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Pestillo	No identificado	15	Hierba	Maleza
Rodia de jolote	No identificado	10	Hierba	Material organica
Chucho	*Peperomia ssp.* *PIPERACEAS*	20	Hierba	Ecologico
Pufa	No identificado	3	Arbusto	Material organica

Sub parcela 5: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 8-10 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Chupa	*Gustavia ssp.* *LECYTHIDACEAE*	1	Arbosto	Alimento aves
Huele de noche	*Cestrum aurantiacum* *SOLANACEAE*	2	Arbusto	Alimento aves

Quequisque de monte	*Xantonomus ssp*	2	Arbusto	Alimento
Chucho	*Peperomia ssp. PIPERACEAS*	40	Hierba	Ecologico
Pestillo	No identificado	15	Hierba	Maleza
Rodia de jolote	No identificado	5	Hierba	Material organico

Sendero: Léon Transecto B

Parcela 1: Arbusto, arbols mayores y iguales a 1,5 m, 0-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Huesito	*Guettarda ssp. RUBIACEAE*	2	Arbol	Ecologico
Coco	*Mucura ssp. FABACEAE*	1	Arbol	Madera Construccion Alimento aves y mamiferos
Posan	*Ocotea strigosa* LAURACEAE	3	Arbol	Madera Construccion, Alimento aves y mamiferos

Parcela 2: Arbusto, arbols mayores y iguales a 1,5 m, 10-20 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Coco	*Mucura ssp. FABACEAE*	3	Arbol	Alimento fauna
Posan	*Ocotea strigosa* LAURACEAE	1	Arbol	Alimento aves
Cola de mono	*Cythea arborea CYTHEACEAE*	1	Arbol	Ornamental
Pacaya	*Chamaedorea tepejilote ARECACEAE*	35	Arbol	Ornamental
Linase	*LINACEAE*	1	Arbusto	Ecologico

Sub parcela 1: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 0-2 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Tomatillo	*Lycianthes ssp. SOLANACEAE*	8	Arbusto	Alimento aves
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	4	Arbusto	Ornamental
Comida de culebra	*Casearia ssp. FLACOURTIACEAE*	1	Arbusto	Alimento reptil
Cola guapote	*Psicotria sp* RUBIACEAE	4	Arbusto	Ornamental

Sub parcela 2: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 2-4 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Tomatillo	*Lycianthes ssp.* *SOLANACEAE*	4	Arbusto	Alimento aves
Platanillo	*Nasturtium ssp.* *TROPAEOLACEAE*	2	Hierbas	Ornamental
Cola guapote	*Psicotria sp* RUBIACEAE	1	Hierbas	Ornamental
Cola de mono	*Cythea arborea* *CYTHEACEAE*	1	Arbusto	Ornamental
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	3	Arbusto	Ornamental

Sub parcela 3: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 4-6 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Platanillo	*Nasturtium ssp.* *TROPAEOLACEAE*	1	Arbusto	Ornamental
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	4	Arbusto	Ornamental
Comida de culebra	*Casearia ssp.* *FLACOURTIACEAE*	5	Arbusto	Alimento reptil
Tomatillo	*Lycianthes ssp.* *SOLANACEAE*	2	Arbusto	Alimento aves

Sub parcela 4: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 6-8 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Tomatillo	*Lycianthes ssp.* *SOLANACEAE*	12	Arbusto	Alimento aves
Cola guapote	*Psicotria sp* RUBIACEAE	4	Arbusto	Ornamental
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	1	Arbusto	Medicinal Ornamental

Sub parcela 5: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 8-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Platanillo	*Nasturtium ssp.* *TROPAEOLACEAE*	4	Arbusto	Ornamental
Tomatillo	*Lycianthes ssp.* *SOLANACEAE*	5	Arbusto	Alimento aves
Comida de culebra	*Casearia ssp.* *FLACOURTIACEAE*	7	Arbusto	Alimento reptil
Pavon	*Cupania glabra* *SAPINDACEAE*	1	Arbusto	Medicinal

Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	4	Arbusto	Medicinal Ornamental

Sendero: Léon Transecto C

Parcela 1: Arbusto, arbols mayores y iguales a 1,5 m, 0-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Lengua de vaca	*Rumex crispus POLIGONACEAEP*	4	Arbol	Ecologico
Cogollo colorado	*Tillandsia ssp. BROMELICEAE*	1	Arbol	Alimento aves
Posan	*Ocotea strigosa* LAURACEAE	2	Arbol	Madera Construccion Alimento fauna
Huesito	*Guettarda ssp. RUBIACEAE*	1	Arbol	Ecologico
Maria	*Miconia ssp. MELASTOMATACEAE*	2	Arbol	Construccion Alimento

Parcela 2: Arbusto, arbols mayores y iguales a 1,5 m, 10-20 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Roble	*Quercus brenesii FAGACEAE*	1	Arbol	Madera Construcsion Comercial
Achotillo	*Nephelium lappaceum SAPINDACEAE*	3	Arbol	Ecologico
Posan	*Ocotea strigosa* LAURACEAE	2	Arbol	Construction Alimento aves
Coquillo	*Cyperus rotundus. L. CYPERACEAE*	1	Arbol	Construccion
Golondrina	*Euphorbia ssp. EUPHORBIACEAE*	1	Arbol	Construccion
Cogollo colorado	*Tillandsia ssp. BROMELICEAE*	1	Arbol	Alimento fauna y aves

Sub parcela 1: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 0-2 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Pacaya	*Chamaedorea tepejilote ARECACEAE*	1	Arbusto	Ornamental
Chucho	*Peperomia ssp. PIPERACEAS*	4	Hierbas	Maleza
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	3	Arbusto	Ornamental Medicina

Musgo	*Bazzania schlimania LEPIDOZIACEAE*	3.1 %	Musgo	Ornamental

Sub parcela 2: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 2-4 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Bejuco de roble	Bejuco = *Ipomoea CONVOLVULACEAE*	1	Arbusto	Enrredadera
Chucho	*Peperomia ssp. PIPERACEAS*	2	Hierbas	Maleza
Musgo	*Bazzania schlimania LEPIDOZIACEAE*	37.5 %	Musgo	Ornamental

Sub parcela 3: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 4-6 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Comida de culebra	*Casearia ssp. FLACOURTIACEAE*	4	Arbusto	Alimento reptils
Musgo	*Bazzania schlimania LEPIDOZIACEAE*	37.5 %	Musgo	Ornamental

Sub parcela 4: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 6-8 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Comida de culebra	*Casearia ssp. FLACOURTIACEAE*	4	Arbusto	Alimen to reptiles
Musgo	*Bazzania schlimania LEPIDOZIACEAE*	75.0 %	Musgo	Ornamental

Sub parcela 5: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 8-10 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	4	Arbusto	Medicinal Ornamental
Bromelia	*Guzmania angustifolia BROMELIACEAE*	1	Epifita	Ornamental
Comida de culebra	*Casearia ssp. FLACOURTIACEAE*	4	Arbusto	Alimento serpientos

Sendero: Léon Transecto D

Parcela 1: Arbusto, arbols mayores y iguales a 1,5 m, 0-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Granadilla	*Caesalpinia ssp. FABACEAE*	1	Arbol	Madeza Construccion
Guaba	*Phytolacca ssp. PHYTOLACCACEAE*	1	Arbol	Leña
Comida de pava	No identificado	1	Arbusto	Alimen to aves
Majagua	*Heliocorpus appendiculatus TILIACEAE*	1	Arbol	Hacer Mecate
Chuchacha	No identificado	2	Arbol	Ecologico
Boton	*Conocarpus erecta COMBRETACEAE*	1	Arbol	Ornamental Alimen to aves
Jaboncillo	*Phytolacca ssp. PHYTOLACCACEAE*	1	Arbol	Ecologico
Tabaco	*Verbesina oerstediana ASTERACEAE*	1	Arbol	Ecologico
Pata	*Musa ssp. MUSACEAE*	3	Arbol	Ecologico
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	1	Arbol	Ornamental

Sub parcela 1: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 0-2 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Trinitaria	*Bouganvillea ssp. NYCTAGINACEAE*	5	Arbusto	Ornamental
Sombrerillo	*Hydrocotyle ssp. APIACEAE*	15	Hierbas	No tiene
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	13	Arbusto	Ornamental Medicina
Lechuguilla	*Conyza ssp. ASTERACEAE*	6	Hierbas	Ornamental

Sub parcela 2: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 2-4 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Tomatillo	*Lycianthes ssp. SOLANACEAE*	5	Arbusto	Alimento aves
Lechuguilla	*Conyza ssp. ASTERACEAE*	5	Hierbas	Ornamental
Zacate	*Echinocloa ssp. POACEAE*	6	Hierbas	Maleza

Sub parcela 3: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 4-6 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Platanillo	*Nasturtium ssp. TROPAEOLACEAE*	7	Arbusto	Ornamental
Chicoria	*Eryngium campestre L. UMBELIFERAS*	1	Hierbas	Medicina
Zacate	*Echinocloa ssp. POACEAE*	1	Zacate	Maleza

Sub parcela 4: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 6-8 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Platanillo	*Nasturtium ssp. TROPAEOLACEAE*	20	Arbusto	Ornamental
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	6	Arbusto	Medicina Ornamental
Sombrerillo	*Hydrocotyle ssp. APIACEAE*	15	Hierba	Maleza

Sub parcela 5: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 8-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Maratan	No identificado	20	Hierba	Maleza
Sombrerillo	*Hydrocotyle ssp. APIACEAE*	30	Hierba	Maleza
Platanillo	*Nasturtium ssp. TROPAEOLACEAE*	11	Arbusto	Ornamental
Zacate	*Echinocloa ssp. POACEAE*	15	Hierba	Maleza

Sendero: Léon Transecto E

Parcela 1: Arbusto, arbols mayores y iguales a 1,5 m, 0-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Mampas	No identificado	1	Arbol	Leña
Golondrina	*Euphorbia ssp. EUPHORBIACEAE*	1	Arbol	Madera
Sara	*Copernicia ssp. ARECACEAE*	1	Arbol	Madera Alimento aves

Parcela 2: Arbusto, arbols mayores y iguales a 1,5 m, 10-20 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Majagua	*Heliocorpus appendiculatus TILIACEAE*	1	Arbol	Tejas Mecate
Lisaquin	No identificado	1	Arbol	Construccion

Huesito	*Guettarda ssp. RUBIACEAE*	1	Arbol	Ecologico
Palo de fierro	*Tabebuia ssp. BIGNONIACEAE*	1	Arbol	Ecologico
Chuchacha	No identificado	1	Arbol	Ecologico
Carrizon	*Lasacis ruscifolia var.Velutina POACEAE*	19	Arbusto	Artesanias

Sub parcela 1: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 0-2 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Lisaquin	No identificado	1	Arbusto	Madera
Cogollo colorado	*Tillandsia ssp. BROMELICEAE*	1	Arbusto	Madera
Carrizon	*Lasacis ruscifolia var.Velutina POACEAE*	1	Arbusto	Hacer canasto
Lechugon	No identificado	4	Hierba	Hacer canasto

Sub parcela 2: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 2-4 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Chicicaste	*Chicicaste ssp. LOASACEAE*	1	Arbusto	Ecologico
Cogollo colorado	*Tillandsia ssp. BROMELICEAE*	1	Arbusto	Madera
Lechugon	No identificado	3	Hierba	Hacer canasto

Sub parcela 3: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 4-6 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Chuchita	No identificado	3	Hierba	Ecologico
Cogollo colorado	*Tillandsia ssp. BROMELICEAE*	1	Arbusto	Madera
Jagua	*Genipa ssp. RUBIACEAE*	1	Arbusto	Madera
Bejuco de roble	Bejuco = *Ipomoea CONVOLVULACEAE*	1	Arbusto	Enrredadera
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	2	Hierba	Ornamental

Sub parcela 4: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 6-8 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Cogollo colorado	*Tillandsia ssp. BROMELICEAE*	1	Arbusto	Madera
Ojoche	*Pseudolmedia ssp. MORACEAE*	1	Arbusto	Madera

Carrizon	*Lasacis ruscifolia var.Velutina (Swallen) Davidse POACEAE*	6	Arbusto	Hacer canasto

Sub parcela 5: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 8-10 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Carrizon	*Lasacis ruscifolia var.Velutina POACEAE*	20	Arbusto	Hacer canasto
Cogollo colorado	*Tillandsia ssp. BROMELICEAE*	1	Arbusto	Madera
Tizay	No identificado	1	Arbusto	Leña
Aquacate	*Ocotea paulii LAURACEAE*	1	Arbusto	Madera
Tempisque	*Mastichodendron capiri SAPINDACEAE*	4	Arbusto	Madera
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	4	Hierba	Ornamental

Sendero: Léon Transecto F

Parcela 1: Arbusto, arbols mayores y iguales a 1,5 m, 0-10 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Cogollo colorado	*Tillandsia ssp. BROMELICEAE*	1	Arbol	Alimento aves
Sangregrado	*Pterocarpus ssp. FABACEAE*	3	Arbol	Medicina
Posan	*Ocotea strigosa* LAURACEAE	1	Arbol	Construccion
Sara	*Copernicia spp. ARECACEAE*	1	Arbol	Alimento aves
Pata	*Musa ssp. MUSACEAE*	2	Arbol	Ecologico
Mampas	No identificado	2	Arbol	Leña
Majagua	*Heliocorpus appendiculatus TILIACEAE*	1	Arbol	Mecate Tejas
Huesito	*Guettarda ssp. RUBIACEAE*	1	Arbol	Ecologico

Parcela 2: Arbusto, arbols mayores y iguales a 1,5 m, 10-20 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Guarumo	*Cecropia peltata CECROPIACEAE*	3	Arbol	Alimento aves Medicina
Sangregrado	*Pterocarpus ssp. FABACEAE*	1	Arbol	Medicina

Majagua	*Heliocorpus appendiculatus TILIACEAE*	1	Arbol	Mecate Tejas
Patacon	*Cissampelos ssp. MENISPERMACEAE*	1	Arbol	Ecologico
Cogollo colorado	*Tillandsia ssp. BROMELICEAE*	1	Arbol	Alimento aves
Pata de paloma	*Calathea ssp. MARANTHAEAE*	1	Arbusto	No tiene
Huesito	*Guettarda ssp. RUBIACEAE*	2	Arbol	Ecologico
Lisaquin	No identificado	2	Arbol	Construccion

Sub parcela 1: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 0-2 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	16	Hierba	Ornamental
Enredadera	*Antigonon spp. POLYGONACEAE*	4	Hierba	Ornamental
Bejuco de roble	Bejuco = *Ipomoea CONVOLVULACEAE*	1	Arbusto	Enrredadera
Coco	*Mucura ssp. FABACEAE*	1	Arbusto	Sombra y fruta
Ojoche	*Pseudolmedia ssp. MORACEAE*	1	Arbusto	Madera
Cola guapote	*Psicotria sp* RUBIACEAE	3	Hierba	Ornamental
Chucho	*Peperomia ssp. PIPERACEAS*	30	Hierba	Ecologico

Sub parcela 2: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 2-4 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Guaba	*Phytolacca ssp. PHYTOLACCACEAE*	2	Arbusto	Madera Sombra
Lisaquin	No identificado	3	Arbusto	Madera Sombra
Jagua	*Genipa ssp. RUBIACEAE*	4	Arbusto	Leña
Canelo	Family *CANNABACEAS*	1	Arbusto	Madera
Ojoche	*Pseudolmedia ssp. MORACEAE*	1	Arbusto	Madera
Cola guapote	*Psicotria sp* RUBIACEAE	3	Hierba	Ornamental
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	2	Hierba	Ornamental

Sub parcela 3: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 4-6 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Ojoche	*Pseudolmedia ssp. MORACEAE*	1	Arbusto	Madera
Lisaquin	No identificado	1	Arbusto	Madera Sombra
Huesito	*Guettarda ssp. RUBIACEAE*	1	Arbusto	Madera
Cola guapote	*Psicotria sp* RUBIACEAE	7	Hierba	Ornamental
Lechugon	No identificado	3	Hierba	Ornamental
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	5	Hierba	Ornamental
Enredadera	*Antigonon ssp. POLYGONACEAE*	5	Hierba	Ornamental

Sub parcela 4: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 6-8 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Coludo	*Nephrdepis multiflora DAVALLIACEAE*	10	Hierba	Ornamental
Friojol	*Phaseolus vulgaris FABACEAE*	1	Hierba	Alimento venado
Ojoche	*Pseudolmedia ssp. MORACEAE*	1	Arbusto	Madera
Jagua	*Genipa ssp. RUBIACEAE*	1	Arbusto	Leña
Platanillo	*Nasturtium ssp. TROPAEOLACEAE*	1	Arbusto	Ornamental
Chucho	*Peperomia ssp. PIPERACEAS*	1	Hierba	Ecologico
Cogollo colorado	*Tillandsia ssp. BROMELICEAE*	1	Arbusto	Alimento aves
Quesillo	*Malvaviscos ssp. MALVACEAE*	1	Arbusto	Alimento aves

Sub parcela 5: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 8-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	1	Hierba	Ornamental
Jagua	*Genipa ssp. RUBIACEAE*	2	Arbusto	Leña
Zapotillo	*Pouteria ssp. SAPOTACEAE*	1	Arbusto	Madera

Ojoche	*Pseudolmedia ssp.* *MORACEAE*	1	Arbusto	Madera
Bejuco de roble	Bejuco = *Ipomoea* *CONVOLVULACEAE*	1	Arbusto	Enrredadera
Chucho	*Peperomia ssp.* *PIPERACEAS*	35	Hierba	Ecologico

Sendero: Léon Transecto G

Parcela 1: Arbusto, arbols mayores y iguales a 1,5 m, 0-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Vara blanca	*Hedyosmum mexicanum* *CLORANTACEAE*	1	Arbol	Construccion
Achotillo	*Nephelium lappaceum* *SAPINDACEAE*	1	Arbol	Leña
Lengua de vaca	*Rumex crispus* *POLIGONACEAEP*	1	Arbol	Ecologico
Guarumo	*Cecropia peltata* *CECROPIACEAE*	2	Arbol	Alimento aves Medicina
Pata	*Musa ssp.* *MUSACEAE*	54	Arbol	Ecologico

Parcela 2: Arbusto, arbols mayores y iguales a 1,5 m, 10-20 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Lechoso	*Apocynaceae tabernaemontana* *APOCYNACEAE*	1	Arbol	Maderable Alimento murciélago
Mampas	No identificado	6	Arbol	Leña
Lengua de vaca	*Rumex crispus* *POLIGONACEAEP*	15	Arbusto	Ecologico
Guarumo	*Cecropia peltata* *CECROPIACEAE*	1	Arbol	Alimento aves Medicina
Labios de puta	No identificado	1	Arbusto	Ornamental
Lisaquin	No identificado	4	Arbol	Construccion
Huesito	*Guettarda ssp.* *RUBIACEAE*	3	Arbol	Ecologico
Jagua	*Genipa ssp.* *RUBIACEAE*	1	Arbusto	Leña
Pata	*Musa ssp.* *MUSACEAE*	1	Arbol	Ecologico

Sub parcela 1: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 0-2 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	1	Arbusto	Medicina
Hoja hedionda	*Solanum ssp*.	2	Hierba	Maleza

SOLANACEAE

Sub parcela 2: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 2-4 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Comida de culebra	*Casearia ssp.* *FLACOURTIACEAE*	1	Hierba	Alimento reptil
Musgo	*Bazzania schlimania* *LEPIDOZIACEAE*	9.4 %	Musgo	Ornamental
Sombrerillo	*Hydrocotyle ssp.* *APIACEAE*	3	Hierba	Maleza
Helecho	*Nephrolepsis biserratat* *DAVALLIACEAE*	1	Arbusto	Medicina

Sub parcela 3: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 4-6 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	3	Arbusto	Medicina
Bejuco de carrizon	Bejuco = *Ipomoea* *CONVOLVULACEAE*	1	Epifita	Maleza

Sub parcela 4: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 6-8 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	4	Arbusto	Medicina
Jagua	*Genipa ssp.* *RUBIACEAE*	4	Arbusto	Leña
Cugia	*Parathesis ssp.* *MYRSINACEAE*	2	Arbusto	Alimento fauna
Zapotillo	*Pouteria ssp.* *SAPOTACEAE*	2	Arbusto	Madera
Caimito	*Chrysophyllum caimito* *ZAPOTACEAE*	3	Arbusto	Leña
Coloudo	*Nephrdepis multiflora* *DAVALLIACEAE*	2	Hierba	Ornamental

Sub parcela 5: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 8-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	3	Arbusto	Medicina
Jagua	*Genipa ssp.*	3	Arbusto	Leña

	RUBIACEAE			
Enredadera	*Antigonon ssp.* *POLYGONACEAE*	5	Hierba	Ornamental
Tempisque	*Mastichodendron capiri* *SAPINDACEAE*	1	Arbusto	Madera

Sendero: Léon Transecto H

Parcela 1: Arbusto, arbols mayores y iguales a 1,5 m, 0-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Lechoso	*Apocynaceae tabernaemontana* *APOCYNACEAE*	2	Arbol	Alimento mamiferos Construccion
Nancito	*Hieronyma ssp.* *PHYLLANTHACEAE*	1	Arbol	Madera
Mampas	No identificado	1	Arbol	Leña
Cugia	*Parathesis ssp.* *MYRSINACEAE*	1	Arbol	Alimento aves
Chuchacha	No identificado	1	Arbol	Ecologico
Guaba	*Phytolacca ssp.* *PHYTOLACCACEAE*	1	Arbol	Leña Sombra
Posan	*Ocotea strigosa* LAURACEAE	1	Arbol	Madera Construccion Alimento aves

Parcela 2: Arbusto, arbols mayores y iguales a 1,5 m, 10-20 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Majagua	*Heliocorpus appendiculatus Turez* *TILIACEAE*	1	Arbol	Mecate Tejas
Guarumo	*Cecropia peltata* *CECROPIACEAE*	1	Arbol	Alimento aves Medicina
Chicharron	*Guazuma ulmifolia* *STERCULIACEAE*	1	Arbol	Ecologico
Lisaquin	No identificado	1	Arbol	Madera
Achotillo	*Nephelium lappaceum* *SAPINDACEAE*	8	Arbol	Ecologico
Brasil	*Chlorophora tinctorea* *MORACEAE*	2	Arbol	Alimento aves
Lengua cusco	No identificado	1	Arbusto	Leña
Comida de pava	No identificado	1	Arbusto	Alimento aves
Pata de paloma	*Calathea ssp.* *MARANTHAEAE*	1	Arbusto	No tiene

Sub parcela 1: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 0-2 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	7	Arbusto	Medicina Ornamental
Corona cristo	*Euphorbia ssp. EUPHORBIACEAE*	1	Epiphytas	Maleza
Lechugon	No identificado	2	Hierba	Maleza
Hoja hedionda	*Solanum ssp. SOLANACEAE*	1	Hierba	Maleza

Sub parcela 2: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 2-4 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	10	Arbusto	Medicina
Hoja largo	No identificado	15	Hierba	Maleza
Hechogone	No identificado	4	Hierba	Meleza
Hoja hedionda	*Solanum ssp. SOLANACEAE*	3	Hierba	Maleza

Sub parcela 3: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 4-6 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	3	Arbusto	Medicina
Hoja hedionda	*Solanum ssp. SOLANACEAE*	11	Hierba	Maleza
Rosetillo	*Randia ssp. RUBIACEAE*	1	Hierba	Maleza
Hoja largo		4	Hierba	Maleza

Sub parcela 4: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 6-8 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Hoja largo	No identificado	4	Hierba	Maleza
Hoja hedionda	*Solanum ssp. SOLANACEAE*	3	Hierba	Maleza

Sub parcela 5: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 8-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	10	Arbusto	Medicina
Ojo de venado	*Mucura ssp. FABACEAE*	1	Epifita	Maleza

Hoja largo	No identificado	10	Hierba	Maleza
Hoja hedionda	*Solanum ssp*. *SOLANACEAE*	2	Hierba	Maleza
Zacate	*Echinocloa ssp.* *POACEAE*	1	Hierba	Maleza

Sendero: Léon Transecto I

Parcela 1: Arbusto, arbols mayores y iguales a 1,5 m, 0-10 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Labios de puta	No identificado	1	Arbusto	Ornamental
Guaba	*Phytolacca ssp.* *PHYTOLACCACEAE*	1	Arbol	Maleza
Lechoso	*Sapium macrocarpum* *EUPHORBIACEAE*	1	Arbol	Leña
Camito	*Chrysophyllum caimito* *ZAPOTACEAE*	1	Arbol	Alimento aves
Chicharron	*Guazuma ulmifolia* *STERCULIACEAE*	1	Arbol	Ecologica
Lisaquin	No identificado	1	Arbol	Maleza
Pata de paloma	*Calathea ssp.* *MARANTHAEAE*	1	Arbusto	No tiene
Zapotillo	*Freziera guatemalensis* *THEACEA*	1	Arbol	Construccion Alimento aves
Comida de pava	No identificado	1	Arbusto	Alimento aves
Posan	*Ocotea strigosa* LAURACEAE	2	Arbol	Madeza

Parcela 2: Arbusto, arbols mayores y iguales a 1,5 m, 10-20 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Lisaquin	No identificado	2	Arbol	Madeza
Canelo	Family *CANNABACEAS*	2	Arbol	Madeza Alimento aves
Cogollo colorado	*Tillandsia ssp.* *BROMELICEAE*	2	Arbol	Alimento aves
Posan	*Ocotea strigosa* LAURACEAE	1	Arbol	Madeza
Pata de paloma	*Calathea ssp.* *MARANTHAEAE*	2	Arbusto	No tiene

Sub parcela 1: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 0-2 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Lechugon	No identificado	4	Arbusto	Medicina
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	5	Hierba	Maleza

Batata	*Convolvulus batatas L.* *CONVOLVULACEAE*	1	Hierba	Maleza

Sub parcela 2: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 2-4 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Lechugon	No identificado	12	Hierbas	Medicina
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	3	Arbusto	Medicina
Hoja largo	No identificado	4	Arbusto	Maleza

Sub parcela 3: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 4-6 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Sombrerillo	*Hydrocotyle ssp.* *APIACEAE*	5	Hierba	Maleza
Lechugon	No identificado	8	Hierba	Maleza
Pestillo	No identificado	4	Hierba	Maleza
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	7	Hierba	Maleza
Hoja largo	No identificado	4	Arbusto	Medicina Ornamental

Sub parcela 4: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 6-8 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Lechugon	No identificado	5	Hierba	Maleza
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	12	Hierba	Medicina
Musgo	*Bazzania schlimania* *LEPIDOZIACEAE*	75 %	Musgo	Ornamental
Bejuco de palo	Bejuco = *Ipomoea* *CONVOLVULACEAE*	5	Epifita	Maleza

Sub parcela 5: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 8-10 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Musgo	*Bazzania schlimania* *LEPIDOZIACEAE*	9.4 %	Musgo	Ornamental
Sombrerillo	*Hydrocotyle ssp.* *APIACEAE*	20	Hierba	Maleza
Bejuco de palo	Bejuco = *Ipomoea* *CONVOLVULACEAE*	23	Epifita	Maleza
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	1	Arbusto	Medicina

Sendero: Léon Transecto J

Parcela 1: Arbusto, arbols mayores y iguales a 1,5 m, 0-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Vara blanca	*Hedyosmum mexicanum CLORANTACEAE*	1	Arbol	Construccion
Chilamate	*Ficus ssp. MORACEAE*	1	Arbol	Construccion Alimento aves
Coñito	No identificado	1	Arbol	Alimento mamiferos
Cogollo colorado	*Tillandsia ssp. BROMELICEAE*	1	Arbol	Construccion Alimento aves
Sara	*Copernicia ssp. ARECACEAE*	1	Arbol	Alimento aves
Aguacate montaña	*Ocotea paulii LAURACEAE*	1	Arbol	Construccion Alimento aves
Troton	No identificado	1	Arbol	Construccion Alimento mamiferos
Pata de paloma	*Calathea ssp. MARANTHAEAE*	8	Arbusto	No tiene
Tronador	*Hura ssp. EUPHORBIACEAE*	12	Arbusto	No tiene
Chila congo	*Sicana ssp. CUCURBITACEAE*	4	Arbusto	No tiene
Labios de puta	No identificado	1	Arbusto	Ornamental

Parcela 2: Arbusto, arbols mayores y iguales a 1,5 m, 10-20 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Majagua	*Heliocarpus appendiculatus TILIACEAE*	2	Arbol	Mecate Tejas
Cogollo colorado	*Tillandsia ssp. BROMELICEAE*	6	Arbol	Alimento aves Madera
Tronador	*Hura ssp. EUPHORBIACEAE*	3	Arbusto	No tiene
Labios de puta	No identificado	1	Arbusto	Ornamental
Palo de agua	*Bravaisia ssp. ACANTHACEAE*	1	Arbusto	No tiene
Huesito	*Guettarda ssp. RUBIACEAE*	2	Arbusto	No tiene
Alamo	*Populus fremontii SALICACEAE*	1	Arbol	Madera Construccion
Sangregrado	*Pterocarpus ssp. FABACEAE*	1	Arbol	Medicinal
Maria	*Miconia ssp. MELASTOMATACEAE*	1	Arbol	Construccion Sombra

Sub parcela 1: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 0-2 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	60	Hierba	Ornamnental
Cola guapote	*Psicotria sp* RUBIACEAE	5	Hierba	Ornamental
Bejuco alquitrán	Bejuco = *Ipomoea CONVOLVULACEAE*	8	Epifita	No tiene
Sombrerillo	*Hydrocotyle ssp. APIACEAE*	5	Hierba	No tiene

Sub parcela 2: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 2-4 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	43	Hierba	Ornamnental
Cola guapote	*Psicotria sp* RUBIACEAE	10	Hierba	Ornamental
Lechugon	No identificado	3	Hierba	Maleza
Bejuco de carrizon	Bejuco = *Ipomoea CONVOLVULACEAE*	5	Epifita	Maleza

Sub parcela 3: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 4-6 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	35	Hierba	Ornamental Medicina
Bromelia	*Guzmania angustifolia BROMELICACEAE*	1	Epifita	Ornamental
Bejuco de palo	Bejuco = *Ipomoea CONVOLVULACEAE*	1	Epifita	Maleza
Bejuco de carrizon	Bejuco = *Ipomoea CONVOLVULACEAE*	1	Epifita	Maleza

Sub parcela 4: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 6-8 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	30	Hierba	Medicina
Bejuco de palo	Bejuco = *Ipomoea CONVOLVULACEAE*	3	Epifita	No tiene
Chicoria	*Eryngium campestre L. UMBELIFERAS*	1	Hierba	Medicina
Hoja hedionda	*Solanum ssp*.	1	Hierba	Maleza

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Sub parcela 5: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 8-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Orquídeas	*ORCHIDACEAE*	2	Epifita	Ornamental
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	20	Hierba	Medicina
Bejuco de palo	Bejuco = *Ipomoea CONVOLVULACEAE*	5	Epifita	Maleza
Hoja largo	No identificado	4	Hierba	Maleza
Bromelia	*Guzmania angustifolia BROMELICACEAE*	2	Epifita	Ornamental

Sendero: Léon Transecto K

Parcela 1: Arbusto, arbols mayores y iguales a 1,5 m, 0-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Lisaquin	No identificado	7	Arbol	Maleza
Cañamo	*Cannabis sativa L. CANNABACEAS*	1	Arbol	Maleza
Lechoso	*Apocynaceae tabernaemontana APOCYNACEAE*	1	Arbol	Maleza Alimento murciélago
Zorrillo	*Aegiphila ssp. VERBENACEAE*	1	Arbol	Maderable Medicinal
Maria	*Miconia ssp. MELASTOMATACEAE*	1	Arbol	Maleza Alimento aves
Areno	*Hernalium racemosum FLACOURITACEAE*	1	Arbol	Madera
Posan	*Ocotea strigosa* LAURACEAE	1	Arbol	Maleza
Comida de pava	No identificado	1	Arbusto	Alimento aves
San rafael	*Senecio ssp. ASTERACEAE*	1	Arbol	Construccion
Vainillo	*Cassia ssp. FABACEAE*	1	Arbusto	No tiene

Parcela 2: Arbusto, arbols mayores y iguales a 1,5 m, 10-20 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Posan	*Ocotea strigosa* LAURACEAE	9	Arbol	Madera Construccion
Cogollo colorado	*Tillandsia ssp. BROMELICEAE*	2	Arbol	Madera
Lechoso	*Apocynaceae tabernaemontana APOCYNACEAE*	1	Arbol	Madera Alimento murciélago

Vara blanca	*Hedyosmum mexicanum CLORANTACEAE*	2	Arbol	Madera
Pisguin	*Albizia ssp. FABACEAE*	1	Arbol	Ecologico
Zorillo	*Aegiphila ssp. VERBENACEAE*	1	Arbol	Madera Medicina
Labios de puta	No identificado	2	Arbusto	Ornamental
Matasanillo	*Crateva tapia CAPPARIDACEAE*	1	Arbol	Madera
Chilamate	*Ficus ssp. MORACEAE*	2	Arbol	Alimento mono
Lengua de vaca	*Rumex crispus POLIGONACEAEP*	1	Arbol	Ecologico
Lisaquin	No identificado	7	Arbol	Madera
Comida de pava	No identificado	1	Arbusto	Alimento aves
Pata de paloma	*Calathea ssp. MARANTHAEAE*	8	Arbusto	No tiene

Sub parcela 1: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 0-2 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	2	Hierba	Medicina
Bejuco de palo	Bejuco = *Ipomoea CONVOLVULACEAE*	4	Epifita	Maleza
Hoja hedionda	*Solanum ssp. SOLANACEAE*	4	Hierba	Maleza

Sub parcela 2: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 2-4 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Cola guapote	*Psicotria sp* RUBIACEAE	1	Arbusto	Maleza
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	1	Hierba	Medicina
Bejuco de palo	Bejuco = *Ipomoea CONVOLVULACEAE*	1	Epifita	Maleza
Hoja largo	No identificado	1	Hierba	Maleza

Sub parcela 3: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 4-6 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Bejuco de palo	Bejuco = *Ipomoea CONVOLVULACEAE*	1	Epifita	Maleza
Hoja largo	No identificado	6	Hierba	Maleza
Sombrerillo	*Hydrocotyle ssp. APIACEAE*	1	Hierba	Maleza

Sub parcela 4: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 6-8 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Bejuco de roble	Bejuco = *Ipomoea CONVOLVULACEAE*	1	Epifita	Maleza
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	3	Hierba	Medicina
Sombrerillo	*Hydrocotyle ssp. APIACEAE*	4	Hierba	No tiene
Hoja largo	No identificado	2	Hierba	No tiene

Sub parcela 5: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 8-10 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	3	Hierba	Medicina
Hoja largo	No identificado	2	Hierba	No tiene
Bejuco de palo	Bejuco = *Ipomoea CONVOLVULACEAE*	2	Epifita	Maleza
Bromelia	*Guzmania angustifolia BROMELICACEAE*	1	Epifita	Ornamental

Sendero: Campanero Transecto A

Parcela 1: Arbusto, arbols mayores y iguales a 1,5 m, 0-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Lisaquin	No identificado	1	Arbol	Madera
Coñito	No identificado	2	Arbol	Madera Alimento mamiferos
Canelo	*CANNABACEAS*	1	Arbol	Madera Alimento aves
Posan	*Ocotea strigosa* LAURACEAE	1	Arbol	Madera Alimento aves
Saray	*Syagrus ssp.* *ARECACEAE*	1	Arbol	Ecologico
Lengua de vaca	*Rumex crispus* *POLIGONACEAEP*	1	Arbusto	Ecologico
Huesito	*Guettarda ssp.* *RUBIACEAE*	1	Arbusto	Ecologico
Labiosa puta	No identificado	1	Arbusto	Ornamental
Maria	*Miconia ssp.* *MELASTOMATACEAE*	2	Arbol	Construccion Alimento aves
Caimito	*Chrysophyllum caimito* *ZAPOTACEAE*	1	Arbusto	No tiene

Parcela 2: Arbusto, arbols mayores y iguales a 1,5 m, 10-20 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Aguacate	*Ocotea paulii* *LAURACEAE*	1	Arbol	Madera
Guaba	*Phytolacca ssp.* *PHYTOLACCACEAE*	3	Arbol	Madera
Matasanillo	*Crateva tapia* *CAPPARIDACEAE*	1	Arbol	Madera
Maria	*Miconia ssp.* *MELASTOMATACEAE*	2	Arbol	Madera Alimento fauna, aves y mamoferos
Golondrina	*Euphorbia ssp.* *EUPHORBIACEAE*	1	Arbol	Madera
Vara blanca	*Hedyosmum mexicanum* *CLORANTACEAE*	1	Arbol	Construccion
Tronador	*Hura ssp.* *EUPHORBIACEAE*	1	Arbusto	No tiene
Lengua de vaca	*Rumex crispus* *POLIGONACEAEP*	5	Arbusto	Ecologico
Huesito	*Guettarda ssp.* *RUBIACEAE*	4	Arbusto	No tiene
Labios de puta	No identificado	4	Arbusto	Ornamental

Sub parcela 1: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 0-2 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	2	Hierba	Medicinal Ornamental
Pestillo	No identificado	4	Hierba	Maleza
Hoja largo	No identificado	5	Hierba	No tiene

Sub parcela 2: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 2-4 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Comida de celebra	*Casearia ssp. FLACOURTIACEAE*	12	Hierba	Alimento de culebra
Cola guapote	*Psicotria sp* RUBIACEAE	4	Arbusto	Ornamental
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	3	Hierba	Ornamental
Bromelia	*Guzmania angustifolia BROMELICACEAE*	1	Epifita	Ornamental
Bejuco de palo	Bejuco = *Ipomoea CONVOLVULACEAE*	3	Epifita	No tiene

Sub parcela 3: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 4-6 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Comida de celebra	*Casearia ssp. FLACOURTIACEAE*	40	Hierba	Alimento serpientes
Platanillo	*Nasturtium ssp. TROPAEOLACEAE*	4	Arbusto	Ornamental
Bejuco de palo	Bejuco = *Ipomoea CONVOLVULACEAE*	5	Epifita	No tiene

Sub parcela 4: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 6-8 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Comida de celebra	*Casearia ssp. FLACOURTIACEAE*	8	Hierba	Alimento de culebra
Hoja hedondia	*Solanum ssp*. *SOLANACEAE*	5	Hierba	Maleza
Hoja largo	No identificado	8	Hierba	Maleza

Sub parcela 5: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 8-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Bejuco de roble	Bejuco = *Ipomoea CONVOLVULACEAE*	1	Arbusto	No tiene
Bejuco de palo	Bejuco = *Ipomoea*	3	Epifita	No tiene

	CONVOLVULACEAE			
Pestillo	No identificado	4	Hierba	Maleza
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	4	Hierba	Medicina

Sendero: Campanero Transecto C*

Parcela 1: Arbusto, arbols mayores y iguales a 1,5 m, 0-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Lisaquin	No identificado	2	Arbol	Madera
Cogollo colorado	*Tillandsia ssp. BROMELICEAE*	1	Arbol	Madera Alimento aves
Jagua	*Genipa ssp. RUBIACEAE*	6	Arbol	Leña
Aguacate	*Ocotea paulii LAURACEAE*	1	Arbol	Madera
Guabo	*Quassia amara SIMAROUBACEAE*	1	Arbol	Madera
Areno	*Hernalium racemosum FLACOURTIACEAE*	1	Arbol	Madera

Parcela 2: Arbusto, arbols mayores y iguales a 1,5 m, 10-20 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Jagua	*Genipa ssp. RUBIACEAE*	4	Arbol	Leña
	Chrysophyllum caimito ZAPOTACEAE	3	Arbusto	No tiene
Ojoche	*Pseudolmedia ssp. MORACEAE*	1	Arbusto	Madera
Lisaquin	No identificado	3	Arbol	Madera
Cogollo colorado	*Tillandsia ssp. BROMELICEAE*	5	Arbol	Madera Alimento aves
Coco	*Mucura ssp. FABACEAE*	2	Arbol	Leña
Bejuco de roble	Bejuco = *Ipomoea CONVOLVULACEAE*	3	Arbusto	Maleza

Sub parcela 1: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 0-2 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Jagua	*Genipa ssp. RUBIACEAE*	4	Arbusto	Leña
Enredadera	*Antigonon ssp. POLYGONACEAE*	4	Arbusto	Ornamental
Roble	*Cybistax ssp. BIGNONIACEAE*	2	Arbusto	Madera

Ojoche	*Pseudolmedia ssp.* *MORACEAE*	1	Arbusto	Madera
Bejuco de roble	Bejuco = *Ipomoea* *CONVOLVULACEAE*	2	Arbusto	Madera
Aguacate	*Ocotea paulii* *LAURACEAE*	1	Arbusto	Madera Construccion
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	10	Hierba	Medicina
Saray	*Syagrus ssp.* *ARECACEAE*	1	Arbusto	Madera
Azahar	*Citrus sinensis* *RUTACEAE*	1	Arbusto	Madera
Guaba	*Phytolacca ssp.* *PHYTOLACCACEAE*	1	Arbusto	Sombra Leña

Sub parcela 2: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 2-4 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Jagua	*Genipa ssp.* *RUBIACEAE*	3	Arbusto	Leña
Ojoche	*Pseudolmedia ssp.* *MORACEAE*	1	Arbusto	Madera
Tizay	No identificado	1	Arbusto	Leña
Guaba	*Phytolacca ssp.* *PHYTOLACCACEAE*	1	Arbusto	Leña
Zapotillo	*Pouteria ssp.* *SAPOTACEAE*	1	Arbusto	Madera
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	3	Hierba	Medicina
Pacaya	*Chamaedorea tepejilote* *ARECACEAE*	10	Arbusto	Ecologico

Sub parcela 3: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 4-6 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Jagua	*Genipa ssp.* *RUBIACEAE*	1	Arbusto	Leña
Guabo	*Quassia amara* *SIMAROUBACEAE*	1	Arbusto	Madera
Areno	*Hernalium racemosum* *FLACOURTIACEAE*	1	Arbusto	Madera
Cogollo colorado	*Tillandsia ssp.* *BROMELICEAE*	1	Arbusto	Madera Alimento aves
Lisaquin	No identificado	1	Arbusto	Madera
Helecho	*Nephrolepsis biserrata*	6	Hierba	Medicina

	DAVALLIACEAE			
Coco	*Mucura ssp.*	1	Arbusto	Leña
	FABACEAE			Sombra

Sub parcela 4: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 6-8 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Lisaquin	No identificado	2	Arbusto	Madera
Guaba	*Phytolacca ssp.*	2	Arbusto	Leña
	PHYTOLACCACEAE			
Cugia	*Parathesis ssp.*	1	Arbusto	Madera
	MYRSINACEAE			
Helecho	*Nephrolepsis biserrata*	3	Hierba	Medicina
	DAVALLIACEAE			

Sub parcela 5: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 8-10 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Coco	*Mucura ssp.*	1	Arbusto	Sombra
	FABACEAE			Leña
Azahar	*Citrus sinensis*	1	Arbusto	Madera
	RUTACEAE			
Lisaquin	No identificado	1	Arbusto	Madera
Jagua	*Genipa ssp.*	2	Arbusto	Leña
	RUBIACEAE			
Helecho	*Nephrolepsis biserrata*	2	Hierba	Medicina
	DAVALLIACEAE			
Aguacate	*Ocotea paulii*	1	Arbusto	Madera
	LAURACEAE			
Platanillo	*Nasturtium ssp.*	1	Arbusto	Ecologico
	TROPAEOLACEAE			

Sendero: Campanero Transecto B

Parcela 1: Arbusto, arbols mayores y iguales a 1,5 m, 0-10 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Guaba	*Phytolacca ssp.*	3	Arbol	Madera
	PHYTOLACCACEAE			Construccion
Lisaquin	No identificado	1	Arbol	Madera
Aguacate montaña	*Ocotea paulii*	1	Arbol	Madera
	LAURACEAE			
Achiotillo	*Nephelium lappaceum*	1	Arbusto	No tiene
	SAPINDACEAE			
Palo de agua	*Bravaisia ssp.*	1	Arbusto	No tiene
	ACANTHACEAE			
Pata de paloma	*Calathea ssp.*	1	Arbusto	No tiene
	MARANTHAEAE			

Parcela 2: Arbusto, arbols mayores y iguales a 1,5 m, 10-20 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Lisaquin	No identificado	10	Arbol	Madera Construccion
Maria	*Miconia ssp.* *MELASTOMATACEAE*	1	Arbol	Madera Construccion
Posan	*Ocotea strigosa* LAURACEAE	4	Arbol	Madera Alimento murciélago
Guaba	*Phytolacca ssp.* *PHYTOLACCACEAE*	3	Arbol	Madera Construccion
Cugia	*Parathesis ssp.* *MYRSINACEAE*	1	Arbol	Alimento aves
Vara blanca	*Hedyosmum mexicanum* *CLORANTACEAE*	1	Arbol	Madera
Achiotillo	*Nephelium lappaceum* *SAPINDACEAE*	4	Arbusto	No tiene
Caimito	*Chrysophyllum caimito* *ZAPOTACEAE*	1	Arbusto	No tiene
Labios de puta	No identificado	5	Arbusto	Ornamental
Palo de agua	*Bravaisia ssp.* *ACANTHACEAE*	8	Arbusto	No tiene

Sub parcela 1: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 0-2 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	5	Hierba	Medicina Ornamental
Chucho	*Peperomia ssp.* *PIPERACEAS*	1	Arbusto	Maleza
Hoja hedionda	*Solanum ssp*. *SOLANACEAE*	40	Hierba	Maleza

Sub parcela 2: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 2-4 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Hoja hedionda	*Solanum ssp*. *SOLANACEAE*	60	Hierba	No tiene
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	4	Hierba	Medicina
Bejuco de palo	Bejuco = *Ipomoea* *CONVOLVULACEAE*	1	Epifita	No tiene
Musgo	*Bazzania schlimania* *LEPIDOZIACEAE*	9.4 %	Musgo	Ornamental

Sub parcela 3: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 4-6 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Hoja hedionda	*Solanum ssp*. *SOLANACEAE*	50	Hierba	No tiene
Comida de celebra	*Casearia ssp.* *FLACOURTIACEAE*	4	Hierba	Alimento culebra
Bejuco de palo	Bejuco = *Ipomoea* *CONVOLVULACEAE*	1	Epifita	No tiene

Sub parcela 4: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 6-8 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	3	Hierba	Medicine
Lechugon	No identificado	1	Arbusto	No tiene
Comida sepiente	No identificado	20	Hierba	Alimento serpiento
Hoja hedionda	*Solanum ssp*. *SOLANACEAE*	8	Hierba	No tiene
Bejuco de palo	Bejuco = *Ipomoea* *CONVOLVULACEAE*	5	Epifita	No tiene

Sub parcela 5: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 8-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Hoja largo	No identificado	8	Hierba	No tiene
Hoja hedionda	*Solanum ssp*. *SOLANACEAE*	30	Hierba	No tiene
Bejuco de roble	Bejuco = *Ipomoea* *CONVOLVULACEAE*	1	Arbusto	No tiene
Bejuco de palo	Bejuco = *Ipomoea* *CONVOLVULACEAE*	2	Epifita	No tiene
Lechugon	No identificado	1	Arbusto	No tiene

Sendero: Campanero Transecto B*

Parcela 1: Arbusto, arbols mayores y iguales a 1,5 m, 0-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Palo de Maria	*Casearia ssp.* *SALICACEAE*	5	Arbol	Madera
Jagua	*Genipa ssp.* *RUBIACEAE*	5	Arbol	Leña
Cogollo colorado	*Tillandsia ssp.* *BROMELICEAE*	3	Arbol	Madera
Matasanillo	*Crateva tapia* *CAPPARIDACEAE*	1	Arbol	Madera
Guabo	*Quassia amara* *SIMAROUBACEAE*	2	Arbol	Madera

Lisaquin	No identificado	1	Arbol	Madera Construccion
Azahar	*Citrus sinensis* *RUTACEAE*	1	Arbol	Madera Fruta

Parcela 2: Arbusto, arbols mayores y iguales a 1,5 m, 10-20 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Palo de Maria	*Casearia ssp.* *SALICACEAE*	10	Arbol	Madera
Jagua	*Genipa ssp.* *RUBIACEAE*	7	Arbol	Leña
Cogollo colorado	*Tillandsia ssp.* *BROMELICEAE*	4	Arbol	Madera
Roblencito	*Quercus alba* *FAGACEAE*	1	Arbol	Madera Alimento aves
Saray	*Syagrus ssp.* *ARECACEAE*	1	Arbol	Ecologico
Ojoche	*Pseudolmedia ssp.* *MORACEAE*	1	Arbusto	Madera
Cugia	*Parathesis ssp.* *MYRSINACEAE*	2	Arbol	Madera Fruta
Roble blanco	*Licania ssp.* *CHRYSOBALANACEAE*	1	Arbol	Madera

Sub parcela 1: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 0-2 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Jagua	*Genipa ssp.* *RUBIACEAE*	5	Arbusto	Leña
Palo de Maria	*Casearia ssp.* *SALICACEAE*	10	Arbusto	Madera
Limoncillo	*Randia ssp.* *RUBIACEAE*	2	Arbusto	Leña
Zapotillo	*Pouteria ssp.* *SAPOTACEAE*	1	Arbusto	Madera
Cugia	*Parathesis ssp.* *MYRSINACEAE*	2	Arbusto	Madera
Enredadera	*Antigonon ssp.* *POLYGONACEAE*	2	Arbusto	Ornamental
Lechugon	No identificado	3	Arbusto	Ecologico

Sub parcela 2: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 2-4 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Maria	*Miconia ssp.* *MELASTOMATACEAE*	1	Arbusto	Madera
Lisaquin	No identificado	1	Arbusto	Madera Construccion
Roblencito	*Quercus alba*	1	Arbusto	Madera

	FAGACEAE			
Jagua	*Genipa ssp.* *RUBIACEAE*	1	Arbusto	Leña
Bejuco de roble	Bejuco = *Ipomoea* *CONVOLVULACEAE*	2	Arbusto	Maleza
Guabo	*Quassia amara* *SIMAROUBACEAE*	3	Arbusto	Madera
Enredadera	*Antigonon ssp.* *POLYGONACEAE*	3	Arbusto	Ornamental

Sub parcela 3: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 4-6 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Roblencito	*Quercus alba* *FAGACEAE*	2	Arbusto	Madera
Palo de Maria	*Casearia ssp.* *SALICACEAE*	1	Arbusto	Madera
Alamo	*Populus fremontii* *SALICACEAE*	1	Arbusto	Madera Construccion
Ojoche	*Pseudolmedia ssp.* *MORACEAE*	1	Arbusto	Madera
Enredadera	*Antigonon ssp.* *POLYGONACEAE*	2	Arbusto	Maleza
Guabo	*Quassia amara* *SIMAROUBACEAE*	2	Arbusto	Madera
Bromelia	*Guzmania angustifolia* *BROMELICACEAE*	1	Epifita	Ornamental

Sub parcela 4: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 6-8 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Guabo	*Quassia amara* *SIMAROUBACEAE*	11	Arbusto	Madera
Lisaquin	No identificado	1	Arbusto	Madera Construccion
Jagua	*Genipa ssp.* *RUBIACEAE*	3	Arbusto	Leña
Enredadera	*Antigonon ssp.* *POLYGONACEAE*	2	Arbusto	Maleza
Bejuco de roble	Bejuco = *Ipomoea* *CONVOLVULACEAE*	2	Arbusto	Maleza

Sub parcela 5: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 8-10 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Jagua	*Genipa ssp.* *RUBIACEAE*	1	Arbusto	Leña
Guabo	*Quassia amara* *SIMAROUBACEAE*	6	Arbusto	Madera

Cogollo colorado	*Tillandsia ssp. BROMELICEAE*	2	Arbusto	Madera
Zapotillo	*Pouteria ssp. SAPOTACEAE*	1	Arbusto	Madera
Enredadera	*Antigonon ssp. POLYGONACEAE*	3	Arbusto	Maleza

Sendero: Campanero Transecto C

Parcela 1: Arbusto, arbols mayores y iguales a 1,5 m, 0-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Mampa	No identificado	1	Arbol	Maleza
Comida de pava	No identificado	3	Arbusto	Alimento aves
Guaba	*Phytolacca ssp. PHYTOLACCACEAE*	4	Arbol	Construccion
Guarumo	*Cecropia peltata CECROPIACEAE*	2	Arbol	Alimento aves y mamiferos
Tamarrindo	*Tamarindos indica FABACEAE*	1	Arbol	Construccion
Achiotillo	*Nephelium lappaceum SAPINDACEAE*	1	Arbusto	Ecologico
Pata de paloma	*Calathea ssp. MARANTHAEAE*	1	Arbusto	No tiene
Huesito	*Guettarda ssp. RUBIACEAE*	1	Arbusto	No tiene
Labios de puta	No identificado	1	Arbusto	Ornamental

Parcela 2: Arbusto, arbols mayores y iguales a 1,5 m, 10-20 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Mancha	*Virola ssp. MYRISTICACEAE*	1	Arbol	No tiene
Tempisque	*Mastichodendron capiri SAPINDACEAE*	1	Arbol	Construccion Alimento aves
Cogollo colorado	*Tillandsia ssp. BROMELICEAE*	2	Arbol	Alimento fauna
Majagua	*Heliocarpus appendiculatus Turez. TILIACEAE*	1	Arbol	Teja
Sangregrado	*Pterocarpus spp. FABACEAE*	1	Arbol	Medicinal
Vara blanca	*Hedyosmum mexicanum CLORANTACEAE*	1	Arbol	Construccion
Guabo	*Quassia amara SIMAROUBACEAE*	2	Arbol	Construccion
Guamono	*Cecropia peltata CECROPIACEAE*	2	Arbol	Alimento aves y mamiferos
Palo de agua	*Bravaisia ssp.*	1	Arbusto	No tiene

	ACANTHACEAE			
Huesito	*Guettarda ssp.* *RUBIACEAE*	1	Arbusto	No tiene
Labios de puta	No identificado	1	Arbusto	Ornamental

Sub parcela 1: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 0-2 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Chicoria	*Eryngium campestre L.* *UMBELIFERAS*	5	Hierba	Medicina
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	3	Hierba	Medicina
Pestillo	No identificado	6	Hierba	Maleza

Sub parcela 2: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 2-4 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Bejuco de palo	Bejuco = *Ipomoea* *CONVOLVULACEAE*	1	Epifita	No tiene
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	2	Hierba	Medicina

Sub parcela 3: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 4-6 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Hoja hedionda	*Solanum spp*. *SOLANACEAE*	4	Hierba	Maleza
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	5	Hierba	Medicina
Bejuco de palo	Bejuco = *Ipomoea* *CONVOLVULACEAE*	6	Epifita	Maleza

Sub parcela 4: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 6-8 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	4	Hierba	Medicina
Hoja largo	No identificado	3	Hierba	Maleza
Lechugon	No identificado	1	Hierba	Medicina
Bejuco de palo	Bejuco = *Ipomoea* *CONVOLVULACEAE*	3	Epifita	No tiene

Sub parcela 5: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 8-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Hoja hedionda	*Solanum spp*. *SOLANACEAE*	6	Hierba	Maleza
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	4	Hierba	Medicina
Bejuco de palo	Bejuco = *Ipomoea* *CONVOLVULACEAE*	6	Epifita	No tiene
Chicoria	*Eryngium campestre L. UMBELIFERAS*	3	Hierba	Medicina

Sendero: Campanero Transecto A*

Parcela 1: Arbusto, arbols mayores y iguales a 1,5 m, 0-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Lisaquin	No identificado	4	Arbol	Madera
Azahar	*Citrus sinensis* *RUTACEAE*	2	Arbol	Madera
Jagua	*Genipa ssp.* *RUBIACEAE*	5	Arbol	Leña
Limoncillo	*Randia ssp.* *RUBIACEAE*	3	Arbol	Leña
Saray	*Syagrus ssp.* *ARECACEAE*	1	Arbol	Ecologico
Guabo	*Quassia amara* *SIMAROUBACEAE*	8	Arbol	Madera
Areno	*Hernalium racemosum* *FLACOURTIACEAE*	2	Arbol	Madera
Pacaya	*Chamaedorea tepejilote* *ARECACEAE*	7	Arbol	Hacer en casas

Parcela 2: Arbusto, arbols mayores y iguales a 1,5 m, 10-20 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Jagua	*Genipa spp.* *RUBIACEAE*	6	Arbol	Leña
Caimito	*Chrysophyllum caimito* *ZAPOTACEAE*	3	Arbusto	No tiene
Guabo	*Quassia amara* *SIMAROUBACEAE*	2	Arbol	Madera
Lisaquin	No identificado	3	Arbol	Madera
Cogollo colorado	*Tillandsia ssp.* *BROMELICEAE*	3	Arbol	Madera Alimento aves
Coco	*Mucura ssp.* *FABACEAE*	1	Arbol	Ecologico
Azahar	*Citrus sinensis*	2	Arbol	Madera

	RUTACEAE			
Palo de Maria	*Casearia ssp.* *SALICACEAE*	2	Arbol	Madera

Sub parcela 1: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 0-2 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Canelo	Family *CANNABACEAS*	1	Arbusto	Madera
Guaba	*Phytolacca spp.* *PHYTOLACCACEAE*	1	Arbusto	Sombra
Saray	*Syagrus ssp.* *ARECACEAE*	1	Arbusto	Madera
Ojoche	*Pseudolmedia ssp.* *MORACEAE*	2	Arbusto	Madera
Bejuco de roble	Bejuco = *Ipomoea* *CONVOLVULACEAE*	1	Arbusto	Maleza
Bejuco de carrizon	Bejuco = *Ipomoea* *CONVOLVULACEAE*	6	Arbusto	Hacer canasto
Platanillo	*Nasturtium ssp.* *TROPAEOLACEAE*	2	Arbusto	Ecologico
Pacaya	*Chamaedorea tepejilote* *ARECACEAE*	1	Arbusto	Ecologico
Lechugon	No identificado	1	Arbusto	Ecologico

Sub parcela 2: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 2-4 m del sendero.

Nombre común	**Nombre scientific**	**Frecuencia**	**Tipo**	**Usos**
Jagua	*Genipa ssp.* *RUBIACEAE*	3	Arbusto	Leña
Lisaquin	No identificado	1	Arbusto	Madera
Lechugon	No identificado	2	Arbusto	Ecologico
Panamá	*Stercula apetala* *STERCULIACEAE*	1	Hierba	Medicinal
Bejuco de roble	Bejuco = *Ipomoea* *CONVOLVULACEAE*	3	Arbusto	Maleza
Alamo	*Populus fremontii* *SALICACEAE*	1	Arbusto	Madera Construccion
Helecho	*Nephrolepsis biserrata* *DAVALLIACEAE*	4	Hierba	Medicinal
Pacaya	*Chamaedorea tepejilote* *ARECACEAE*	2	Arbusto	Ecologico

Sub parcela 3: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 4-6 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Jagua	*Genipa ssp. RUBIACEAE*	1	Arbusto	Leña
Caimito	*Chrysophyllum caimito ZAPOTACEAE*	1	Arbusto	No tiene
Lechugon	No identificado	1	Arbusto	Ecologico
Carrizon	*Lasacis ruscifolia var.Velutina POACEAE*	3	Arbusto	Hacer canasto
Helecho	*Nephrolepsis biserratat DAVALLIACEAE*	4	Hierba	Medicinal

Sub parcela 4: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 6-8 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Canelo	Family *CANNABACEAS*	1	Arbusto	Madera
Azahar	*Citrus sinensis RUTACEAE*	1	Arbusto	Madera
Carrizon	*Lasacis ruscifolia var.Velutina POACEAE*	2	Arbusto	Hacer canasto
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	1	Hierba	Medicinal

Sub parcela 5: Arbusto (shrub), hierbas (herbs), musgo (mosses), líquenes (lichens) y epifitas (epiphytes), 8-10 m del sendero.

Nombre común	Nombre scientific	Frecuencia	Tipo	Usos
Ojoche	*Pseudolmedia ssp. MORACEAE*	1	Arbusto	Madera
Carrizon	*Lasacis ruscifolia var.Velutina POACEAE*	4	Arbusto	Hacer canasto
Helecho	*Nephrolepsis biserrata DAVALLIACEAE*	4	Hierba	Medicina

Translations:

Adornar - ornamental
Alimento aves – bird food
Alimento culebra – snake food
Alimento mamiferos – mammal food
Alimento murciélago – bat food
Alimento serpientos - snake food
Alimento venado – deer food
Maleza - weeds
Sombra - shade
Artesanias - handicrafts
Enrredadera – strangler
Hacer - construction
Hacer canasto – creation of baskets
Hacer en casas – construction of houses
Leña – fire wood
Madera - wood
Mecate – wires
Tejas – construction of roofs